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Journal of Educational Research

OFFICIAL ORGAN OF THE
AMERICAN EDUCATIONAL RESEARCH ASSOCIATION

VOL. XVII · April, 1928 · No. 4

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JOURNAL OF EDUCATIONAL RESEARCH

Official Organ of the American Educational Research Association

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The JOURNAL OF EDUCATIONAL RESEARCH is published at Bloomington, Illinois, monthly, except July and August by the Public School Publishing Co. The subscription price is $4.00; $4.20 in Canada or Mexico; and $4.50 in other foreign countries.

Subscriptions and all communications about reprints or other business matters should be addressed to the Public School Publishing Company, at Bloomington, Illinois.

The editorial office is at Columbus, Ohio. Address all communications on editorial matters to B. R. Buckingham, Director of Bureau of Educational Research, Ohio State University, Columbus, Ohio.

Entered as second-class matter at the Post Office at Bloomington, Illinois under the act of March 3, 1879.

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JOURNAL *of* EDUCATIONAL RESEARCH

Volume XVII APRIL 1928 Number 4

ARE ANY NUMBER COMBINATIONS INHERENTLY DIFFICULT?

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THE DISADVANTAGE of an investigation as thorough, scientific, and scholarly as that of Clapp in his study of the number combinations is that it tends to discourage others from repeating the experiment or delving into immediately related questions. Yet no one study is complete within itself; and the more thorough it is, the more avenues it opens up for further research. A series of investigations recently were undertaken in the research office of the Winnetka public schools, partly to check Clapp and partly to explore fields he had not covered. The purpose underlying the work was to discover which, if any, number combinations—in addition, subtraction, multiplication, and division—were inherently most difficult. More specifically the purpose was to discover the answers to the seven questions which will be discussed in turn in this report.

PROCEDURE

Three forms of test were mimeographed. Form I presented all the combinations[1] in descending order of difficulty as shown by Clapp; that is, the combination most often missed in the Clapp study was placed first, that least often missed was placed last, with

[1] Two combinations in the addition tests, $0 + 7$, $0 + 9$, were accidentally omitted owing to a misprint in Clapp's tables. Throughout this study, therefore, only 98 addition combinations were used. *See* Tables 1, 2, 3, and 4 of Clapp, Frank L., *The Number Combinations: Their Relative Difficulty, and the Frequency of Their Appearance in Textbooks.* Madison, Wisconsin, University of Wisconsin, 1924. 22-29 pp. (Bureau of Educational Research Bulletin No. 2)

the others in order between. Form II was the reverse of Form I; that is, the combination Clapp found easiest came first, the one he found hardest came last, and the rest were arranged in ascending order of difficulty between. Form III began with the hardest combination, then presented the easiest, then the next to the hardest, then the next to the easiest, and so on, alternating the combinations that Clapp found hard and easy.

Form I was given on one day, Form II the next, Form III the third, to 845 Winnetka children in Grades II to VIII, toward the end of the school year. Only 758 children took the multiplication and division test, since second-grade children had not studied the facts of multiplication and division. Children wrote their answers on their test papers. They were given enough time to finish; but they worked rapidly, because they were accustomed to working toward definite speed standards.

A printed form, containing the combinations arranged in random order, was given to children scattered through 44 schools of other cities which were using an experimental edition of the *Washburne Individual Arithmetics*.[2] These children were tested shortly after completing the first learning of the complete set of facts as taught and tested in this text. Six hundred children were tested in addition and subtraction facts in Grade II, 244 in multiplication facts in Grade III, but only 33 children, outside of Winnetka, were tested on division facts. The results from these outside schools were combined with those of Winnetka on Forms I, II, and III (combined) in the part of the study which dealt with difficulty of combinations at the time of learning. The total numbers of children involved in this phase of the experiment were 861 second-grade addition, 535 second-grade subtraction, 399 third-grade multiplication, and 188 third-grade division.

All tests were corrected and tabulated in the research office. The number of times each combination was missed in each grade and on each form of each test was recorded. Combinations were arranged in order of frequency of error for each form of the test.

The quarter of the combinations missed the largest number of times in one form was compared with the quarter most often missed

[2] Washburne, Carleton, and others. *Washburne Individual Arithmetics*. Yonkers, New York, World Book Company, 1925 and 1928.

in each other form and in Clapp. The same was done for the other quarters.[3] Coefficients of correlation were found between one form and another, and between each form and all three forms combined; correlations were also found between each form and Clapp's table in which all grades were combined, and between all forms combined and Clapp's table. Similar comparisons were made between the frequency of error at the time of learning and in later grades, and between Grade IV and Grade VII and between Grade V and Grade VIII. All combinations in all texts used by Winnetka children were tabulated, and the coefficient of correlation between their frequency of occurrence and the frequency of error made by the Winnetka children on the tests was found. Only the most significant tables and results are presented herewith.

RESULTS

1. *Does the order of presentation of combinations in a test materially influence their apparent difficulty?*—Table I shows the percent of error in the first and last quarters of the various forms of the tests. In reading the table, it must be borne in mind that the combinations included in the first quarter of Form I are identical with those included in the last quarter of Form II and vice versa. It will be seen, therefore, that in addition 28 percent of the total errors made in Form I occur in the first quarter of the test, namely, within the hardest quarter of the combinations as indicated by Clapp. In Form II these same combinations occur in the last quarter and are responsible for 32 percent of the total number of errors. Similarly, in subtraction, when the difficult combinations—according to Clapp—occur in the first quarter of the test, they are responsible for 24 percent of the errors, but when they occur in the last part of the test (Form II) they are responsible for 29 percent of the errors. Multiplication tells the same story: the difficult combinations caused 51 percent of the errors if placed in the first part of the test (Form I), 61 percent if placed at the end of the test (Form II). In division facts, the

[3] By "quarter" throughout this article, is meant one-fourth of the list of combinations in question, when these are arranged in the rank order of the number of errors made on each. The quarter of addition combinations missed the largest number of times means, therefore, the 25 (out of 100) combinations on which the largest number of errors occurred.

ratio is 26 percent in the first part of the test and 31 percent in the last part.

Conversely, when the easiest combinations are placed in the first part of the test, as in Form II of the addition test, they are responsible for 16 percent of the errors, while if placed at the end of the test, as in Form I, they are responsible for 18 percent of

TABLE I

PERCENTS OF ERRORS IN FIRST AND LAST QUARTERS OF EACH TEST

	Total Errors	Percent of Errors Found in First Quarter	Percent of Errors Found in Last Quarter
(1)	(2)	(3)	(4)
Addition:			
Form I	1,796	28	18
Form II	1,225	16	32
Form III	1,501	33	21
Subtraction:			
Form I	2,325	24	19
Form II	2,110	14	29
Form III	1,844	32	26
Multiplication:			
Form I	2,445	51	12
Form II	2,217	6	61
Form III	2,024	34	20
Division:			
Form I	1,971	26	23
Form II	2,196	20	31
Form III	1,806	25	21

the errors. In subtraction the ratio is 14 percent to 19 percent; in multiplication, 6 percent to 12 percent; and in division, 20 percent to 23 percent. Apparently, therefore, if the combinations are arranged either in ascending or descending order of difficulty, they are more likely to be missed at the end of the test than they are at the beginning.

Curiously enough, when the combinations are arranged in alternating order, hardest, easiest, next hardest, next easiest, etc., as in Form III of all four tests, the largest percent of error is made in the first quarter (33 percent to 21 percent in addition; 32 per-

cent to 26 percent in subtraction; 34 percent to 20 percent in multiplication; and 25 percent to 21 percent in division). This is doubtless due to the fact that the first quarter of Form III contains the thirteen most difficult combinations, according to Clapp, along with the twelve easiest; whereas, the last quarter of Form III contains the middle twenty-five combinations; the bulk of the errors tend to be made on the thirteen hardest combinations.

Table I would clearly indicate, therefore, that position on the test is a factor in determining the apparent difficulty of the combinations. But, since Form III, by its concentration of difficult combinations at the beginning, reverses the apparent findings of Forms I and II, and, since in every case those combinations which are classified by Clapp as easiest are responsible for a smaller percent of error than those which he classifies as hardest, it is evident that position in the test is a less dominant factor in determining apparent difficulty than is something which seems to inhere in some of the combinations themselves; that is, in the readiness with which the child learns and retains the combinations.

2. *Did children trained under the individual technique, where each child practices consistently on his weak points have difficulty with the same combinations as did the children tested by Clapp?*—The Wisconsin children, reported in Clapp's study, presumably were taught by the class method. Winnetka children are expected to reach 100 percent repeatedly on complete diagnostic tests covering all combinations, and they are given specific drill on combinations they miss. It is interesting to compare the results.

In the first place, the individual work in Winnetka apparently results in greater accuracy, as the median percent of errors in Winnetka, all Grades—II or III to VIII—combined was only 1.9 percent in addition, 2.1 percent in subtraction, 2.2 percent in multiplication, and 2.7 percent in division, against median Wisconsin percents—Grades III to VIII combined—as shown by Clapp of 4.7 percent in addition, 9.6 percent in subtraction, 5.1 percent in multiplication, and 10.0 percent in division.

Table II shows how many of the 25 hardest combinations according to Clapp were in the hardest 25 of the various Winnetka tests; how many of the next hardest 25 (Clapp) were in the second quarter of each form of the Winnetka test, and so on.

A study of this table and subsequent ones shows a decided difference among the processes. What is true of addition is frequently not true of multiplication. In general, however, it will be noted on Table II that usually the hardest and easiest quarters agree better with Clapp than do the intermediate ones. This is because the differences among the combinations are distinctly greater toward the lower and upper extremes than in the middle,

TABLE II

NUMBER OF COMBINATIONS CORRESPONDING WITH CLAPP STUDY IN EACH FOURTH

	Form I	Form II	Form III	All Forms Combined
(1)	(2)	(3)	(4)	(5)
Addition:				
Hardest	7	11	13	11
Next hardest	10	8	7	9
Next easiest	2	7	7	4
Easiest	14	14	14	14
Subtraction:				
Hardest	6	11	8	9
Next hardest	7	5	6	7
Next easiest	6	11	6	9
Easiest	11	13	7	11
Multiplication:				
Hardest	25	23	22	22
Next hardest	17	17	17	17
Next easiest	12	11	9	13
Easiest	16	16	14	17
Division:				
Hardest	11	15	10	11
Next hardest	8	10	6	9
Next easiest	5	8	7	7
Easiest	14	12	17	15

both in Clapp's study and in our own, that is to say, there is a far greater difference in the frequency of error among the hardest combinations and among the easiest than there is among the middle ones.

The coefficients of correlation between the Winnetka tests—all forms combined—and Clapp, if one considers only the hardest and easiest quarters, are: addition, .77 and multiplication, .91. For these same two processes, when the frequency of error of the middle

half of the combinations according to Clapp is correlated with the frequency of error of these same combinations in the Winnetka study the coefficients are found to be for addition .002 and for multiplication .73. This confirms the common-sense conclusion and agrees with the data of Table II. It also justifies us in considering for the most part only the two extremes of the distribution, for the order of difficulty of combinations in the middle half is not consistent and is pedagogically unimportant. The multiplication combinations, as shown by the results given in Table II, are more closely related in the two studies than are any of the others.

These facts are also brought out by the following correlations between the number of times combinations were missed in the Clapp study and in the Winnetka study—all forms combined:

	Coefficients of Correlation
Addition:	
Form I	.37
Form II	.46
Form III	.60
All forms combined	.52
Subtraction:	
Form I	.04
Form II	.22
Form III	.23
All forms combined	.17
Multiplication:	
Form I	.77
Form II	.90
Form III	.90
All forms combined	.93
Division:	
Form I	.35
Form II	.54
Form III	.48
All forms combined	.51

These numbers also show that in addition the mixed-order form gives the best correlation with Clapp; and Form I, hardest combinations first, the poorest correlation. "All forms combined" is made up of three times as many cases as any one form, yet it usually shows a slightly lower correlation with Clapp than does Form III.

Subtraction shows no significant correlation between the Winnetka study and that of Clapp. Again Form III gives the best correlation, but only .23. When it is considered that all forms combined consist of more than two thousand tests, the lack of correlation is significant. Apparently, therefore, for most sub-

traction combinations, the way children are tested and taught makes more difference than any possible inherent difficulty among the subtraction facts. If the reader will turn to the correlations between the numbers of errors made on the different forms of the Winnetka test given further on in this section (see page 243), he will find that the three forms of subtraction test correlate well with each other.

All forms of the Winnetka multiplication test correlate highly with Clapp's study. As in every case, Form I, hardest combinations first, again shows the lowest correlation; but all forms combined, rather than Form III, yields the highest correlation ($r = .93$). We are at a loss to explain why there is so much greater relationship between multiplication difficulties than there is between the other arithmetical processes. It is not due to any closer relationship among the forms of the Winnetka multiplication tests (see open table on page 243); nor is it due to a smaller or larger percent of error, for the median percent of error for the four processes, as has already been stated, is addition, 1.9 percent; subtraction, 2.1 percent; multiplication, 2.2 percent; and division, 2.7 percent. Clearly, there is nothing here to make multiplication stand out. It cannot be due to the frequency of presentation of the multiplication combinations in the text material, since, strangely enough, the very slight relationship which exists between frequency of presentation and frequency of error is, in the case of multiplication facts alone, positive; that is, there is a slight tendency for the number of errors to increase with the frequency of occurrence of the combinations in textbooks. This correlation (.30) must be accidental. The only explanation—which occurs to us—of the relatively high correlation between Clapp's findings and ours in the relative difficulty of multiplication facts, as compared with the other three processes, is that there is an actually greater inherent difference in the difficulty of multiplication combinations than there is in any of the other processes. Our data would seem to point in this direction.

In division facts the highest correlation is between Form II, easiest combinations first, and Clapp's study. The differences, however, among the correlations are small except in the case of Form I which, as already stated, is consistently the lowest.

The correlations between the various forms of the Winnetka test are as follows—most of these correlations are reasonably high:

	Coefficients of Correlation
Addition:	
Forms I and II	.77
Forms I and III	.14
Forms II and III	.52
Subtraction:	
Forms I and II	.90
Forms I and III	.81
Forms II and III	.85
Multiplication:	
Forms I and II	.75
Forms I and III	.81
Forms II and III	.92
Division:	
Forms I and II	.71
Forms I and III	.70
Forms II and III	.69

The data already given would seem to indicate that, while the order of presentation and the method of instruction influence the apparent difficulty of combinations, there is, nevertheless, with the exception of the subtraction facts, a definite correlation between the difficulty of combinations as taught in Wisconsin and tested by Clapp's method and as taught in Winnetka and measured by all three forms of the Winnetka test.

3. *Is the apparent difficulty of certain combinations influenced by the frequency of the occurrence of these combinations in the text materials?*—The correlation between the Wisconsin and Winnetka results may be due to an accidental tendency in the Winnetka materials of instruction to emphasize the same combinations as were emphasized in the Wisconsin textbooks. The correlations between the number of errors found on the test papers of the Winnetka children and frequency of the use of these combinations in arithmetic textbooks disprove this hypothesis. These correlations based on the results from the three tests combined are:

	Coefficients of Correlation
Addition	—.23
Subtraction	—.32
Multiplication	+.30
Division	—.04

These coefficients show that there is no significant correlation between frequency of occurrence in the Winnetka text material and

frequency of error in the tests. There is a very slight negative correlation in the case of addition and subtraction facts, but certainly not enough to be of any significance; while, in division facts the correlation is nil; and in multiplication facts, as already pointed out, such slight correlation as exists is positive. The apparently inherent difficulty found in certain combinations in the Winnetka study is not, therefore, due to under stress in the text material.

4. *Are the combinations which are hardest or easiest in one grade those which are missed often or seldom three grades higher?* —The difficulty of the combinations is here judged by the frequency of error; that is, the hardest combination is the one which

TABLE III

CORRELATION BETWEEN NUMBER OF ERRORS MADE ON COMBINATIONS IN DIFFERENT GRADES

	Grades IV and VII	Grades V and VIII
(1)	(2)	(3)
Addition	−.05	.06
Subtraction	.72	.70
Multiplication	.79	.91
Division	.52	.62

is most often missed, while the one considered the easiest is least often missed. The question which will be considered in this section may be expressed in terms of Winnetka methods as, Does the difficulty of certain combinations persist in spite of attempts at individual remedial work?

Table III presents coefficients of correlation between the number of times each combination is missed—three forms combined—in the fourth grade and the seventh, and similar correlations between the fifth grade and the eighth. The striking fact about this table is the total absence of correlation in the case of addition facts. Whatever inherent difficulty there may have been in these facts, it seems to have disappeared completely by the seventh and eighth grades. On the other hand, there is no such disappearance in any of the other three processes. The correlations in subtraction are

reasonably high and those in division a little lower, while those in multiplication are characteristically the highest of all.

Table III corroborates to some extent the decidedly inconsistent correlation for the addition facts found between the forms of the Winnetka test, the consistently high correlations for the multiplication and subtraction facts, and the slightly lower correlations for the division facts. These correlations, the reader will remember, are given in a previous section. In regard to the subtraction facts, however, both the coefficients of correlation found between the forms of the tests and those given in Table III are decidedly inconsistent with the correlations previously mentioned which were found between Clapp's study and the present investigation. In other words, in regard to subtraction facts the Winnetka children are consistent among themselves regardless of the order of the presentation of the facts in the tests and regardless of grade; but, judged by the combinations which they find hard, they differ radically from the children tested by Clapp.

5. *Which combinations are in the hardest or easiest quarter regardless of the test, the method of teaching, the organization of textbooks, and order of presentation within the tests?*—Table IV shows the fourth of the combinations most and least often missed in the Clapp study, in each of the three forms of the Winnetka study and in that of Clapp, and in all forms of the Winnetka study combined. It lists (in Column 3) those combinations which are found in the most difficult quarter of every form of the Winnetka test and in the most difficult quarter of the Clapp study.

In order to show the correspondence between the results of the Winnetka study and that of Clapp, those combinations which occur in the most difficult quarter according to Clapp are printed in italics in the list of most difficult combinations as shown by the Winnetka study. For example, $9 + 8$ is in the most difficult quarter according to Clapp; and it is printed in italics wherever it occurs in the most difficult quarter of any form of the Winnetka test. Columns 4, 5, and 6 in Table IV present the easiest quarter of the combinations in exactly the same way.

Those combinations which are shown in Column 3 are the ones which were the most difficult regardless of the order of presentation, the form of the test, the method of teaching, the organization

TABLE IV

HARDEST FOURTH AND EASIEST FOURTH OF THE ADDITION, SUBTRACTION, MULTIPLICATION, AND DIVISION COMBINATIONS FOUND IN THE STUDY BY CLAPP AND THOSE FOUND IN THE WINNETKA STUDY

Clapp	In All Forms Combined	In Each of the Three Forms and in Clapp	Clapp	In All Forms Combined	In Each of the Three Forms and in Clapp
(1)	(2)	(3)	(4)	(5)	(6)
Addition—Hardest Fourth			Addition—Easiest Fourth		
8 + 5	7 + 9	7 + 9	0 + 0	0 + 0	0 + 0
7 + 9	0 + 3	9 + 8	5 + 5	2 + 2	2 + 2
5 + 8	0 + 6	5 + 9	2 + 2	1 + 9	4 + 4
9 + 7	0 + 4		2 + 1	1 + 3	9 + 9
6 + 8	0 + 8		1 + 7	7 + 7	1 + 3
6 + 9	0 + 2		1 + 6	9 + 9	7 + 7
5 + 7	0 + 5		1 + 3	5 + 1	1 + 6
7 + 8	8 + 5		8 + 8	1 + 6	2 + 1
8 + 7	9 + 7		9 + 2	2 + 1	
9 + 6	5 + 7		1 + 1	4 + 4	
5 + 9	0 + 1		3 + 3	4 + 1	
8 + 9	6 + 8		5 + 4	8 + 8	
8 + 6	9 + 8		6 + 1	1 + 5	
4 + 7	5 + 7		2 + 0	1 + 2	
7 + 5	9 + 0		7 + 7	4 + 5	
4 + 9	9 + 6		9 + 9	6 + 6	
9 + 5	5 + 8		1 + 8	8 + 1	
9 + 4	6 + 0		4 + 0	5 + 3	
6 + 7	7 + 2		3 + 1	1 + 8	
5 + 6	2 + 7		4 + 1	6 + 4	
4 + 6	5 + 9		4 + 4	4 + 6	
7 + 6	2 + 5		2 + 8	5 + 4	
7 + 4	8 + 0		2 + 5	1 + 4	
9 + 8	8 + 7		2 + 9	1 + 7	
3 + 7			7 + 1	9 + 1	
Subtraction—Hardest Fourth			Subtraction—Easiest Fourth		
14 − 9	5 − 0	11 − 3	0 − 0	0 − 0	0 − 0
13 − 4	9 − 0	14 − 6	5 − 1	4 − 2	4 − 2
16 − 9	6 − 0	16 − 9	7 − 7	14 − 7	5 − 3
14 − 5	3 − 0	13 − 8	3 − 2	7 − 6	9 − 8
17 − 9	2 − 0		3 − 3	5 − 3	5 − 4
15 − 9	7 − 0		6 − 6	10 − 5	6 − 5
17 − 8	8 − 0		4 − 2	6 − 5	
15 − 7	4 − 0		8 − 1	9 − 8	
13 − 9	1 − 0		1 − 1	8 − 4	
13 − 5	16 − 9		5 − 4	12 − 6	

TABLE IV—*Continued*

Clapp	In All Forms Combined	In Each of the Three Forms and in Clapp	Clapp	In All Forms Combined	In Each of the Three Forms and in Clapp
(1)	(2)	(3)	(4)	(5)	(6)
16 − 7	*11 − 3*		5 − 3	*5 − 4*	
13 − 7	1 − 1		9 − 9	*5 − 2*	
13 − 8	*15 − 9*		9 − 1	6 − 4	
11 − 3	*14 − 6*		4 − 4	10 − 1	
14 − 6	*13 − 5*		9 − 8	10 − 6	
12 − 3	*13 − 4*		6 − 5	10 − 8	
15 − 6	*13 − 8*		8 − 4	10 − 9	
14 − 8	15 − 8		5 − 5	4 − 1	
12 − 5	8 − 8		4 − 3	*3 − 2*	
12 − 7	2 − 2		7 − 1	*4 − 3*	
11 − 4	7 − 7		3 − 1	9 − 5	
11 − 6	3 − 3		6 − 3	8 − 7	
16 − 8	*17 − 9*		5 − 2	*6 − 3*	
18 − 9	*15 − 6*		2 − 1	7 − 5	
11 − 9	4 − 4		6 − 1	10 − 7	
Multiplication—Hardest Fourth			Multiplication—Easiest Fourth		
7 × 0	*5 × 0*	8 × 0	0 × 0	*0 × 0*	0 × 0
0 × 5	*1 × 0*	9 × 0	1 × 7	7 × 2	2 × 5
0 × 7	*4 × 0*	4 × 0	5 × 1	*2 × 5*	1 × 8
0 × 1	*8 × 0*	5 × 0	1 × 3	*1 × 8*	7 × 1
4 × 0	*7 × 0*	3 × 0	2 × 5	*1 × 7*	2 × 7
0 × 8	*2 × 0*	2 × 0	1 × 4	*7 × 1*	2 × 2
0 × 2	*9 × 0*	7 × 0	2 × 8	5 × 3	1 × 7
0 × 4	*3 × 0*	1 × 0	9 × 2	*2 × 7*	4 × 1
2 × 0	*6 × 0*	6 × 0	2 × 2	6 × 2	2 × 9
0 × 6	*0 × 9*	0 × 3	1 × 5	*5 × 2*	6 × 1
9 × 0	*0 × 1*	0 × 9	1 × 6	*6 × 1*	
8 × 0	*0 × 7*	0 × 7	2 × 1	1 × 9	
0 × 3	*0 × 3*	0 × 2	2 × 9	*4 × 1*	
6 × 0	*0 × 2*	0 × 8	5 × 4	*1 × 4*	
0 × 9	*0 × 8*	0 × 4	1 × 8	*2 × 2*	
3 × 0	*0 × 4*	0 × 6	6 × 1	3 × 4	
9 × 7	*0 × 5*	0 × 1	3 × 1	9 × 1	
5 × 0	*0 × 6*	0 × 5	3 × 2	*9 × 2*	
1 × 0	*7 × 8*	7 × 8	8 × 2	*2 × 9*	
8 × 7	*8 × 7*	9 × 6	7 × 1	2 × 6	
9 × 6	1 × 6	8 × 7	5 × 2	*5 × 1*	
6 × 9	*9 × 6*		4 × 4	*3 × 2*	
7 × 9	8 × 6		4 × 1	4 × 2	
7 × 8	*6 × 8*		2 × 3	*2 × 3*	
6 × 8	8 × 8		2 × 7	*3 × 1*	

TABLE IV—*Continued*

Clapp	In All Forms Combined	In Each of the Three Forms and in Clapp	Clapp	In All Forms Combined	In Each of the Three Forms and in Clapp
(1)	(2)	(3)	(4)	(5)	(6)
Division—Hardest Fourth			Division—Easiest Fourth		
2 ÷ 2	2 ÷ 1	54 ÷ 9	4 ÷ 2	*25 ÷ 5*	25 ÷ 5
9 ÷ 9	*54 ÷ 9*	9 ÷ 9	25 ÷ 5	*4 ÷ 2*	4 ÷ 2
28 ÷ 4	*9 ÷ 9*	2 ÷ 2	10 ÷ 2	*20 ÷ 5*	20 ÷ 5
1 ÷ 1	18 ÷ 6	7 ÷ 7	9 ÷ 3	*15 ÷ 5*	15 ÷ 5
36 ÷ 4	40 ÷ 5	5 ÷ 5	81 ÷ 9	*14 ÷ 2*	9 ÷ 3
8 ÷ 8	*2 ÷ 2*	6 ÷ 6	6 ÷ 2	*9 ÷ 3*	12 ÷ 6
3 ÷ 3	*7 ÷ 7*	4 ÷ 4	10 ÷ 5	*12 ÷ 6*	14 ÷ 2
6 ÷ 6	*4 ÷ 4*	3 ÷ 3	14 ÷ 2	*21 ÷ 7*	21 ÷ 7
56 ÷ 8	*5 ÷ 5*		15 ÷ 3	20 ÷ 4	8 ÷ 2
54 ÷ 6	*8 ÷ 8*		12 ÷ 2	*12 ÷ 2*	12 ÷ 2
7 ÷ 7	*3 ÷ 3*		8 ÷ 2	35 ÷ 7	15 ÷ 3
5 ÷ 5	*6 ÷ 6*		20 ÷ 5	*8 ÷ 2*	
4 ÷ 4	10 ÷ 5		14 ÷ 7	30 ÷ 6	
63 ÷ 9	24 ÷ 4		16 ÷ 2	*10 ÷ 2*	
0 ÷ 5	42 ÷ 6		36 ÷ 6	*15 ÷ 3*	
0 ÷ 9	18 ÷ 2		12 ÷ 6	*12 ÷ 4*	
54 ÷ 9	36 ÷ 9		15 ÷ 5	0 ÷ 3	
0 ÷ 2	*36 ÷ 4*		12 ÷ 3	*6 ÷ 2*	
0 ÷ 7	27 ÷ 3		30 ÷ 5	*21 ÷ 3*	
0 ÷ 8	16 ÷ 2		21 ÷ 3	16 ÷ 4	
0 ÷ 3	*63 ÷ 9*		21 ÷ 7	6 ÷ 3	
64 ÷ 8	6 ÷ 1		40 ÷ 5	0 ÷ 4	
48 ÷ 8	24 ÷ 8		12 ÷ 4	8 ÷ 4	

of test materials, and the like; that is, they are the ones which Clapp found to be most difficult and which proved to be most difficult in each separate form of the Winnetka test. It is probably safe to assume, therefore, that these combinations are inherently difficult, namely, that for certain psychological reasons it is harder for children to learn such combinations as $7 + 9$, $11 - 3$, 8×0, and $54 \div 9$ than such combinations as $0 + 0$, $4 - 2$, 2×5, and $25 \div 5$. These last examples are taken from the lists of inherently easy combinations found in Column 6 of Table IV.

In view of the earlier tables and correlations, it is not surprising to find that the smallest numbers of inherently difficult or easy combinations are in the addition and subtraction facts, while the

largest number is found in the multiplication facts. An analysis of the difficult combinations and later of the easy ones may throw some light upon the subject of inherent hardness or easiness of combinations.

The addition facts that are inherently most difficult all contain 9 ($7 + 9$, $5 + 9$, $9 + 8$). Most of the remaining 9 combinations occur in the hardest quarter or hardest half of Clapp or one or two Winnetka forms or both; and $6 + 7$ just escapes being included among the most difficult by falling near the middle of Form III.

In general, it would appear that the mere largeness of the addend is the principal cause of inherent difficulty in addition. This confirms Clapp's analysis where he divided the table of 100 combinations into four parts such that the pairs having the largest sums all fell into one quarter and showed that most of the difficult combinations came in this quarter.

Three out of the four inherently most difficult subtraction facts ($16 - 9$, $13 - 8$, $11 - 3$, $14 - 6$) include 8 as one of the members, the remaining one, 9. In the case of $11 - 3$ and $14 - 6$, the 8 is in the difference, while in $13 - 8$ it is in the subtrahend; but the reverse, $13 - 5$ is in the hardest quarter of all tests except Form I, where it comes near the top of the second quarter. In the hardest quarter of all tests except Winnetka Form III, $17 - 9$ appears, and it comes near the middle in this form. But, while $17 - 8$ is in Clapp's hardest quarter, it is not in the hardest quarter of any Winnetka form. Again, the mere size of one or more of the elements in the combination seems to be an important factor. For some unexplained reason, 8 seems to be the stumbling block in subtraction as 9 was in addition.

The inherently difficult multiplication facts are, it will be noted, with only three exceptions (8×7, 9×6, 7×8) numbers multiplied by zero. This is probably due partly to confusion with addition and partly to the difficulty of the concept. That 0×1, 0×2, 0×8, 0×9, should all have the same answer, should all be just 0, is decidedly difficult for a child to realize. On the other hand, 0×0 is in the easiest group; confusion with addition is harmless here and the idea is easy to grasp.

In the case of multiplication, we run into a special difficulty with zero. It is doubtless the universality and reality of this difficulty which cause the unusually high correlation between the Winnetka study and Clapp and among the various forms of the tests used by Winnetka study in the field of multiplication. Those combinations which proved difficult aside from the ones containing zero are, as in the case of addition and subtraction, among those having the largest factors.

All the inherently difficult division facts except $54 \div 9$ turn out to be those which have 1 for the quotient ($9 \div 9$, $3 \div 3$, $6 \div 6$, etc.). The only missing combinations of this series are $8 \div 8$ and $1 \div 1$. Of these, $8 \div 8$ is in the hardest quarter of Clapp, of Form II, and of Form III; it is near the top of the next to the hardest quarter of Form I. But $1 \div 1$ occupies a different quarter of each form of the Winnetka test; and it occurs in the hardest quarter only of Clapp and Form II. The difficulty involved in $9 \div 9$ appears to be due to confusion with subtraction, the answer often being 0. The concept itself may be a cause of difficulty. In division, therefore, as in multiplication, there is a special difficulty which has nothing to do with the size of the combination. The difficulty inheres in dividing a number by itself. The one combination which appears to be consistently difficult outside of this series ($54 \div 9$) involves large factors.

Turning to the easiest combinations, we find that the easiest addition facts are all doubles or 1 and a number. The fact that $1 + 1$, $3 + 3$, $5 + 5$, $6 + 6$, and $8 + 8$ are not in the inherently easiest group, while $2 + 2$, $4 + 4$, $7 + 7$, and $9 + 9$ are, is difficult to understand. It is hard likewise to see why $1 + 3$ and $1 + 6$ are in the easiest group, while $1 + 2$, $1 + 4$, and $1 + 5$ do not appear in this group.

Easiness in addition appears to inhere in the doubling of numbers and in adding the smallest possible number, 1, to other numbers. This last, of course, is the converse of adding 9 to a number, which proved to be characteristic of the hardest combinations.

The easiest subtraction combinations have differences of 1 or 2, except $0 - 0$. The only large pair in this series is $9 - 8$, the rest belonging to the series $5 - 4$, $5 - 3$, $4 - 3$, $4 - 2$, $3 - 2$, $3 - 1$, of which the missing members, $4 - 3$, $3 - 2$, $3 - 1$, all occur in

Clapp's easiest quarter; and $4 - 3$ and $3 - 2$ are found in the easiest quarter of two out of three Winnetka forms and all Winnetka forms combined. The smallness of the elements concerned and partly the smallness of the differences involved is the characteristic feature of the easy subtraction combinations.

With the exception of 0×0, all the easiest multiplication combinations are multiples of 1 and 2. The missing multiples of 1 and 2 in almost all cases come in either the easiest or next easiest quarter of most of the tests. As in the case of subtraction, easiness of multiplication combinations appears to be solely due to the smallness of the factors.

The division facts least often missed usually have divisors of 2, 3, 4, or 5, with quotients of 5 and under. Where the divisor is 2, the quotients run up to 7; where the quotient is 2 or 3, the divisor runs up to 6 in one case and 7 in one. A singular exception in the series is $10 \div 5$. While this is in Clapp's easiest quarter, it is in the hardest quarter in Winnetka Forms I and III, and in the next hardest in Form II. It is notable that in no case is a quotient of 1 among the easiest division facts in a single test or form of a test, while such quotients are common among the hardest division facts. The smallness of factors again appears to be the primary cause of easiness. The special difficulty in division, where 1 is the quotient, prevents combinations having this quotient from appearing among the easiest—no matter how small the factors.

The principal cause of inherent hardness or easiness among combinations appears from this analysis to be the size of the numbers which make them up; for combinations involving large numbers generally tend to be hard, and those involving small numbers tend to be easy. A special cause of easiness in addition seems to lie in the doubling of numbers. In multiplication a special cause of difficulty lies in the multiplication by zero. A special cause of difficulty in division lies in dividing a number by itself. On the whole, therefore, not only do some combinations appear to be inherently hard, but these have certain elements in common which seem to explain their difficulty. Similarly, there is a fair amount of consistency and reasonableness in the inherent easiness of the easiest combinations.

6. *Are the combinations which seem to be inherently difficult or easy in all grades combined, also the ones which are difficult or*

easy at the time of teaching?—Table V lists the combinations which are found to be hardest and easiest; that is, those appearing in the quarter most often or least often missed, respectively, at the

TABLE V

COMBINATIONS IN HARDEST AND EASIEST QUARTERS AT TIME OF LEARNING

ADDITION		SUBTRACTION		MULTIPLICATION		DIVISION	
Hardest Quarter	Easiest Quarter	Hardest Quarter	Easiest Quarter	Hardest Quarter	Easiest Quarter	Hardest Quarter	Easiest Quarter
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
7 + 9	*2 + 2*	15 − 8	*0 − 0*	*7 × 8*	*0 × 0*	2 ÷ 1	*20 ÷ 5*
9 + 7	*0 + 0*	*16 − 9*	8 − 4	7 × 9	3 × 1	36 ÷ 4	18 ÷ 3
9 + 8	4 + 1	*14 − 6*	3 − 1	*8 × 7*	9 × 1	63 ÷ 9	*4 ÷ 2*
6 + 8	*4 + 4*	15 − 9	*9 − 8*	9 × 7	*6 × 1*	18 ÷ 2	*25 ÷ 5*
7 + 8	5 + 5	*13 − 8*	6 − 3	6 × 8	2 × 8	*54 ÷ 9*	12 ÷ 4
5 + 7	*2 + 1*	13 − 5	2 − 1	8 × 8	1 × 9	0 ÷ 7	*15 ÷ 3*
8 + 9	1 + 5	14 − 9	5 − 2	8 × 6	1 × 6	48 ÷ 8	*21 ÷ 7*
5 + 8	1 + 4	13 − 4	12 − 6	*4 × 0*	*4 × 1*	56 ÷ 8	20 ÷ 4
6 + 7	1 + 1	*11 − 3*	11 − 6	6 × 7	*7 × 1*	48 ÷ 6	*12 ÷ 6*
6 + 9	1 + 8	15 − 6	9 − 1	*9 × 0*	*2 × 5*	0 ÷ 9	*14 ÷ 2*
5 + 9	*1 + 3*	17 − 9	8 − 1	*2 × 0*	5 × 4	24 ÷ 8	16 ÷ 4
9 + 6	1 + 2	11 − 4	5 − 1	*1 × 0*	8 × 2	42 ÷ 6	*9 ÷ 3*
4 + 9	6 + 6	12 − 4	6 − 1	*5 × 0*	1 × 4	28 ÷ 4	*8 ÷ 2*
8 + 7	3 + 1	13 − 6	7 − 1	*3 × 0*	8 × 1	72 ÷ 9	*12 ÷ 2*
0 + 9	2 + 9	13 − 7	8 − 6	*7 × 0*	5 × 2	3 ÷ 1	1 ÷ 1
8 + 6	1 + 7	15 − 7	7 − 3	*8 × 0*	*1 × 8*	64 ÷ 8	28 ÷ 7
8 + 5	*1 + 6*	16 − 7	7 − 4	7 × 6	4 × 3	0 ÷ 3	45 ÷ 5
9 + 4	3 + 5	12 − 7	7 − 5	*0 × 9*	5 × 1	*2 ÷ 2*	*15 ÷ 5*
7 + 6	2 + 8	1 − 1	16 − 8	4 × 9	*2 × 2*	27 ÷ 3	16 ÷ 2
9 + 3	9 + 1	13 − 9	9 − 5	*6 × 0*	*2 × 7*	36 ÷ 9	30 ÷ 5
3 + 9	3 + 4	11 − 2	6 − 4	*0 × 7*	*1 × 7*	0 ÷ 1	18 ÷ 9
7 + 5	1 + 9	12 − 3	8 − 5	6 × 9	5 × 3	32 ÷ 4	32 ÷ 8
0 + 7	2 + 4	1 − 0	*5 − 4*	*0 × 1*	4 × 5		
8 + 4	6 + 1	3 − 0	*4 − 2*	9 × 4	2 × 4		
0 + 3	5 + 4	6 − 0	3 − 2	*0 × 2*	3 × 2		

NOTE.—The combinations found in the hardest and easiest quarters of each form of the Winnetka test and in the corresponding sections of Clapp's list are given in italics throughout the table.

time of teaching in Grades II and III. All combinations in corresponding quarters on the Clapp list and in each form of the Winnetka test are set in italics in this Table. For example, 7 + 9 was found to be in the hardest quarter at the time of teaching in Grades II and III. It was in the hardest quarter on Clapp's list

and also in the hardest quarter of each form of the Winnetka test; and, therefore, it is listed in italics in Table V. For the most part the combinations which are found to be difficult throughout the grades are difficult at the time of learning. There is one notable exception—division facts with quotients of 1 appear to be harder in the complete study than in third grade where the division facts have just been taught.

On the whole, Table V indicates that those combinations which are most difficult at the time of learning; that is, which are most frequently missed at the close of the grade in which they are taught, do not differ materially from those which are found to be most difficult in a study of all grades combined.

7. *Are the combinations which seem to be inherently the hardest or easiest among those found hardest or easiest in other published scientific studies?*—The difficulty with any attempt to answer this question satisfactorily is that other investigations have not covered the same ground. In not another single instance, aside from Clapp's study, is there a published list of the relative difficulty of all the combinations in all four processes. Some have made a study of the 45 combinations, ignoring the reverse forms; others have reported only the types of combinations that have seemed hardest; others have investigated only one or two processes. All the investigations,[4] as far as possible, have been checked with the study herein reported. It has in each case been found that, where difficult combinations were reported, they have tallied with those found by Clapp and in the Winnetka study.

PRACTICAL RESULTS

There is definite evidence, gathered from the information summarized in Table IV, that we should give special practice to the

[4] Only the studies presenting comparable data are listed below:

Counts, George S. *Arithmetic Tests and Studies in the Psychology of Arithmetic.* Chicago, University of Chicago Press, 1917. 127 pp. (Supplementary Educational Monographs, No. 4)

Holloway, Harry Vance. "An Experimental Study to Determine the Relative Difficulty of the Elementary Number Combinations in Addition and Multiplication." A Doctor's thesis on file at the University of Pennsylvania, 1914.

Smith, James Henry. "Arithmetical Combinations," *Elementary School Journal*, 21:762-70, June, 1921.

Phelps, C. L. "A Study of Errors in Tests of Adding Ability," *Elementary School Teacher*, 14:29-39, September, 1913.

following number combinations in an attempt to overcome their inherent difficulty:

Addition:
$7 + 9$, $9 + 8$, $5 + 9$
Subtraction:
$16 - 9$, $13 - 8$, $14 - 6$, $11 - 3$
Multiplication:
9×6, 7×8, and all eighteen zero combinations, 0×0 alone being easy
Division:
$54 \div 9$ and all combinations where the quotient is 1.

There is similar evidence that certain combinations, also shown in Table IV, need not be stressed as much as the rest, for they are easily retained by most children.

SUMMARY

1. The order of presentation of combinations in a test tends to influence their apparent difficulty, but certain combinations appear difficult or easy regardless of this order.

2. The errors made by children trained under individual technique are fewer than those made by the children tested by Clapp who had received instruction in class groups. These errors tend, with the exception of subtraction facts, to correlate with the errors Clapp found.

3. Frequency of occurrence in text materials does not seem to have influenced the number of errors made on the various combinations in Winnetka. This may be due to the system by which each child receives individual drill where he shows himself to be weak in diagnostic tests.

4. Those addition combinations which cause difficulty in Grades IV and V bear no relation to the ones which are occasionally missed in Grades VII and VIII, respectively, in Winnetka. But there is a fairly high correlation between frequency of error in the subtraction, multiplication, and division facts missed in Grades IV and V and Grades VII and VIII. The attempt at individual training, while it decreases the number of errors, does not alter the relative difficulty of combinations, except in addition facts where the scores of the upper grade are generally 100.

5. Certain combinations shown in Table IV are in the hardest quarter as shown by Clapp's study of more than seven thousand

Wisconsin children taught, presumably, by the method of class instruction, and tested by Clapp's method and are also in the hardest quarter in all three Winnetka tests, regardless of arrangement, given to more than eight hundred children trained under the individual technique and tested by the Winnetka method. These combinations appear, therefore, to be inherently difficult. Certain other combinations, shown in Table IV prove similarly to be inherently easy.

6. For the most part the combinations found to be inherently hard or easy, as just defined, are among the hardest and easiest, respectively, toward the end of the grade in which they are first taught. The division facts present a notable exception, for those with a quotient of 1, which are generally inherently difficult, prove not to be especially difficult immediately after learning.

7. The combinations found in the studies here reported to be inherently hard or easy are among those found hard or easy in almost every study which present comparable data.

A CLASSIFICATION SYSTEM FOR SUBNORMAL PUPILS OF JUNIOR AND SENIOR HIGH-SCHOOL AGE

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THE PROGRAM for the care of the subnormal pupil has progressed rapidly in Okmulgee, Oklahoma, since the necessity for better adaptation of educational facilities to the needs of the over-age and retarded child was recognized, seven years ago. Special classrooms were organized in the elementary-school buildings at that time. From this small beginning the organization has grown rapidly until today there are special classrooms for pupils less than thirteen years of age in all elementary schools except one—a small six-room building. For all subnormals more than thirteen years old there is provided the center known as Lee Special High School. This building has five rooms for academic subjects; a manual-training shop and a general shop for boys; a domestic-science laboratory, a domestic-arts room, and an arts-and-crafts room for girls; and a gymnasium. Recreation, supervised play, and corrective exercises which are so necessary for both the boys and girls are provided in the playroom.

The attempt to care for pupils who are more than thirteen years of age in the elementary-school buildings is inadvisable because of both physical and social needs. At the beginning of each new semester, therefore, all pupils from the special classes in the elementary schools who have passed their thirteenth birthdays during the last semester are sent to Lee Special High School regardless of grade. All children of more than thirteen years who enter from other towns and have not yet completed the fifth grade are given an achievement test and an individual intelligence test. If results of these tests show an *IQ* of 80 or below, with achievement-test results and social reactions corresponding, the pupil is sent directly to the Lee Special High School.

Let us consider briefly the types of children who appear at Lee for classification. Some are very large for their ages; others are malnourished, physically unfit, and undersized. The chronological ages of these pupils lie between thirteen and seventeen; the mental

ages range from six to twelve years; and the school grades vary from the first to the sixth. Some pupils come from schools which give automatic promotions; many others come from systems which attempt to hold pupils in a given grade until they have completed the standard requirements of that grade. Our method of classification is based on four factors—chronological age and physical development, mental age, intelligence quotients, and educational achievement.

It was not difficult to make office records of the pupils of our special class using the regular grade classification, but a serious problem was encountered in preparing a pupil's report card to be sent home. For instance, a child who had been automatically promoted to Grade VII-B in another system is working with a child sent from Grade V-B, and both are actually doing academic work of difficulty equivalent to that of IV-B. What grade should be put on the card to satisfy the needs of the pupil and the parent, as well as the school's records?

During the first two years after the organization of the center, normal over-age pupils also were enrolled in the department. These received promotion to the regular high school at the completion of the sixth grade. Pupils endowed with less ability were held at Lee because they were incapable of doing high-school work. A few from other groups with grade cards showing marks for VII-A and VII-B were sent on for various reasons but had to be entered in the VII-B grade at the regular high school. These two situations bred a spirit of discontent among some of the pupils left at Lee.

Many and varied were the questions brought to harass the teacher. Solomon would have had need of all his wisdom to be able to answer satisfactorily the questions about promotions and grading raised by parents and children. Great care and tact had to be used not to diminish the keen interest most of the pupils had come to have for their school. All workers in the Special Department agreed that a new classification was necessary. But what? There was no beaten track to follow.

The first step made was to change the name of our school from Lee Special School to Lee High School. Second, it was decided to admit to this school only those pupils whose intelligence quotients

were low enough to justify the supposition that the child would never be able to carry high-school work. Sometimes, however, children who tested between 80 and 90 came to us with such a record of irregular school attendance and poor home conditions that it seemed necessary to enroll them in special classes where they could be given work adapted to their abilities and closely related to both their present and future needs.

A means had to be found to keep the pupils satisfied with their promotions at Lee High School. The junior high school, if possible, must be freed from the necessity of enrolling pupils entering from small towns and poor schools to have them remain only a short time after the classification was made.[1] After a careful study of the records of children in the special classes it became evident that a small percent of pupils remained in school after reaching the age of sixteen; many dropped between the ages of fourteen and sixteen.

Our problem then was to discover a classification system. The system desired was one which would provide the following:

1. A chance for pupils of the highest type of intelligence in our department to continue work in the regular high school if their efforts and accomplishments justified.
2. Conditions under which a child could be promoted regularly for a period of at least three years.
3. A means of keeping the feeble-minded children in a group apart from the dull and borderline cases, and still allow regular promotions to every pupil who would give his best efforts regardless of his mental standing.
4. A new terminology applied to classification of groups which would bear no relation to the regular method of grade or high-school promotion.
5. A means of satisfying the parent with the new system of classification.

Pupils at Lee High School are grouped into three main divisions. The low division consists of children with an intelligence quotient of less than 70 and a mental age of not more than nine years; the middle group, of children with mental ages of nine or more who more nearly approach the normal in their school attainment and social reactions; the third division, of fifteen- and six-

[1] This condition is due in Okmulgee to a large floating population which shifts because of prevailing industrial conditions.

teen-year-old children capable of doing practical work equal to that offered in the junior high school and children who had been at Lee at least two years and who could carry vocational work as difficult as high-school work but whose academic abilities would never advance to high-school level.

The term "rank" instead of grade has been chosen as one with the most appeal for adolescent pupils, suggesting as it does the idea of advancement which may be achieved through effort, regular attendance, continuance in school, and good conduct. Intermediate rank seems best fitted as a name for the lowest classes. Six numerals are used in this rank, thus allowing a promotion each semester for three years without placing a pupil at any time with the second division of pupils unless in the judgment of the teacher and principal he is found to be improperly placed. Each day this group of pupils is given three periods of handwork; one period of gymnasium; one free-activity period—consisting of story-telling, music appreciation, and auditorium; and three periods of academic work. Advanced rank designates the second class of pupils. Four numerals are used in this rank which allow a promotion each semester for two years, when the pupils are promoted to the superior rank. The term "superior" appeals to the older boys and girls who are with much more difficulty kept interested in school, but who have earned this distinction by continuance in school. Often a discipline case can be appealed to from this angle and encouraged to show superior behavior as well as superior scholastic attainment.

A report card was designed with a motto for encouraging better attendance and more conscientious school work. This motto, "The pupil who does his best never fails at Lee High," was given a place of prominence on the front of the card. A statement, "John's record shows that he has completed the ranks checked below, and is now working in Rank ——," was so worded that the group in which a child was working could be reported when a new classification became effective. It also made it possible to report the classification of a newly entered pupil and the progress all pupils made semester after semester. For instance, if the number of pupils did not justify a division in Advanced I and also Advanced II one semester, the child could work with Advanced II during the

first semester and finish the incomplete work the following semester.

The rest of the card corresponds closely with the regular grade card. Since the future of these children depends upon their habitual reactions to situations in everyday life, the conscientious checking of traits showing the development of character is essential.

The letter which is sent home with the first report a child receives at Lee High School is as follows:

> The Lee High School is planned to meet the needs of the boys and girls of Okmulgee over thirteen who have been placed in the Special Classes of the Okmulgee Schools.
>
> A new course of study has been arranged for this school. This course of study includes the minimum essentials required in the regular grades, besides many vocational subjects not usually offered to boys and girls in the grades. Special attention has been given to choosing material best suited to fit the child's abilities and needs, and to prepare him to become a useful citizen.
>
> These changes necessitate a reclassification of the pupils at Lee High School. They will from now on be grouped in three main divisions, called the Intermediate, the Advanced, and the Superior Ranks. A Roman numeral under each Rank represents a semester's work. Each child who attends regularly and who does his best will be given a promotion at the end of each semester. The grade card will show just how many ranks of work have been completed, and in which group the pupil is working.
>
> At the completion of Superior Rank IV the pupil will be given a diploma showing that he has completed the courses offered by the Lee High School. This diploma will represent at least three years vocational work of two periods a day and courses of academic work which will entitle the holder to enter the ninth grade of the regular High School.

This letter generally goes to parents of little education and often of no more native ability than that of their children. Many terms used in the letter are not familiar to the general public and certainly not to the parents receiving the letter. This apparent discrepancy, however, is intentional. Parents of this type often are incompetent to judge the training their boys and girls should receive. A realization of their own shortcomings strengthens their desires to have the children receive educational training much superior to that which they received and different from that which the child of eleven or twelve is mastering in the fourth, fifth, or even sixth grade. In their estimation the terms "minimum essentials" and "vocational subjects" lend dignity to the course in which their child is now succeeding. It is seldom wise to discour-

age parents of pupils with low intelligence regarding the possibilities of mental development of their children. It is better to adapt the schools to the needs of the children so that each child may gain the inspiration and self-confidence that come from the ability really to excel in doing something he knows to be worth while.

In Okmulgee the less fortunate child is now acquiring the habit of success. Visions of a rosier future than he has had keep the pupil in school. Perhaps, it may even be dreams of a "possible professional career" which inspire the parent to make a greater effort to send his child to school each day. At any rate, he is happy in his school life and stays on day by day acquiring vocational skills, health habits, citizenship training, and the right attitudes toward life, until at last absolute necessity forces him from our midst into the world where he is able to earn his own living because of the school experience adapted to his peculiar needs. This new classification has brought about simplicity of administration, greater cooperation between parent and school, more eagerness on the part of pupils in winning promotions, more zeal in "boosting" their own school, and a better school morale.

FAILURES AND DOUBLE PROMOTIONS IN THE ELEMENTARY SCHOOL

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ADMINISTRATORS have long recognized the fact that one of the most direct measures of school efficiency is the rate at which children progress through the grades. Many investigations of the problem have been reported. Even in the early studies it was recognized that an analysis of the progress of pupils as expressed in crude age-grade indexes was of doubtful reliability and of little meaning. Over-ageness might suggest retardation, but it did not prove it. Moreover, the greatest amount of relative retardation is found not for the over-age pupils but for the younger and more able children in the class. Negative correlation between achievement and chronological age within a grade has shown this many times.

To correct the somewhat obvious error resulting from considering age-grade indexes as expressive of progress, it later became necessary to state a new type of progress index. This newer measure considered only the units of school progress made in relation to the opportunity for progress. A first-grade child who is eight years old is over-age for the grade, but an eight-year-old child who has been in school two semesters and made two semesters of progress is normal.

For a time, the introduction of this new method of expressing school progress seemed to meet all necessary situations. Recently, however, it has been shown that the progress of a pupil may appear to be normal when an actual analysis of the pupil's case shows that it is not. As a matter of fact, the rate of progress which a pupil makes through the grades is determined by the balance he has maintained between the double promotions and failures he has experienced in his school career. If he has had more double promotions than failures, he is accelerated; if he has had more failures than double promotions, he is retarded; and if he has had an equal number of each, he is making regular progress. The real signifi-

cance of this distinction was made clear, in 1926, through a state-wide study of the progress of elementary-school pupils of Iowa.

Data from this larger study constitute the basis for the present discussion.[1] They were obtained from records of the school progress of 37,330 children in Grades I to VIII, inclusive. The number of pupils—boys and girls—who were promoted under annual and semiannual systems of promotion, is shown in Table I. All records were calculated as of January 1, 1926.

ANOTHER METHOD OF INTERPRETING THE FACTS OF PROMOTION

Throughout this discussion it should be kept in mind that a double promotion or a failure in schools which use a scheme of

TABLE I

NUMBER OF PUPILS ENROLLED IN THE SCHOOLS USING EACH SYSTEM OF PROMOTION

Promotion System	Boys	Girls	Total
(1)	(2)	(3)	(4)
Annual	12,735	12,383	25,118
Semiannual	6,082	6,130	12,212
Both combined	18,817	18,513	37,330

annual promotion means a whole year's acceleration or retardation; while in the semiannual promotion systems, it means only a half-year. The greater flexibility of the latter systems accounts for the relatively larger percent of children skipping and failing. It also means that it requires a greater number of children in a school organized under the semester plan to produce a specified number of skips or failures than it does in a school promoting annually. That is, while in the former systems a greater number of children skip or fail, the time gained or lost by each child at each skip or failure is only half the amount of that in a school promoting once a year. For example, in a school that promotes the children once a year, 100 skips or failures are produced by 100 children—provided each child skips or fails only once. It is evident that 200

[1] These data were also used in chapter VI of *Age-Grade and Progress Indices for the Public Elementary Schools of Iowa* by Gustaf Freden (University of Iowa Studies in Education, Vol. IV, No. 2, 1927).

TABLE II

SKIPS AND FAILURES IN ANNUAL AND SEMIANNUAL SYSTEMS OF PROMOTION

	Number of Times									Total Number of Pupils	Percent of Total Number*
	One	Two	Three	Four	Five	Six	Seven	Eight	Nine		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Annual Promotion											
Skipping:											
Boys	176	3	.....	.....	.....	.....	.....	.....	.....	179	1
Girls	216	3	1	.....	.....	.....	.....	.....	.....	220	2
Both	392	6	1	.....	.....	.....	.....	.....	.....	399	2
Failing:											
Boys	2,391	470	100	22	4	.....	.....	.....	.....	2,987	24
Girls	1,553	233	41	11	2	.....	.....	.....	.....	1,840	15
Both	3,944	703	141	33	6	.....	.....	.....	.....	4,827	19
Semiannual Promotion											
Skipping:											
Boys	321	50	5	3	1	.....	.....	.....	.....	380	6
Girls	435	69	5	.....	.....	.....	.....	.....	.....	509	8
Both	756	119	10	3	1	.....	.....	.....	.....	889	7
Failing:											
Boys	1,305	522	185	117	54	32	13	9	.....	2,237	37
Girls	1,089	391	132	60	21	13	2	3	2	1,713	28
Both	2,394	913	317	177	75	45	15	12	2	3,950	32
Both Systems of Promotion											
Skipping:											
Boys	497	53	5	3	1	.....	.....	.....	.....	559	4
Girls	651	72	6	.....	.....	.....	.....	.....	.....	729	5
Both	1,148	125	11	3	1	.....	.....	.....	.....	1,288	4
Failing:											
Boys	3,696	992	285	139	58	32	13	9	.....	5,224	28
Girls	2,642	624	173	71	23	13	2	3	2	3,553	19
Both	6,338	1,616	458	210	81	45	15	12	2	8,777	24

*These percents carried to two decimal places are given in Table 8, Freden, *op cit.*, p. 35.

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children are required in a school which promotes semiannually to produce 100 accelerations or failures of the annual-promotion type. In reality, some children skip more than once; and many children fail more than once, as is shown in Table II. Also, some children both skip and fail.

Two somewhat distinct types of data for skipping and failing and for the two types of promotions are presented in Tables II and III. Table II shows the actual number of pupils who skipped and failed one or more times in the schools which had either annual or semiannual systems of promotion. This table should be read with Table I in mind. Of the 12,735 boys in the annual-promotion systems (see Table I), 176 skipped once and 3 twice, making a total of 179, or 1 percent of the pupils enrolled. Of this same group 2,391 pupils failed once, 470 twice, 100 three times, 22 four times, and 4 five times, making a total of 2,987 pupils, or 24 percent of the number of pupils enrolled in the schools which used the annual system of promotion.

A slightly different interpretation of these same data is given in Table III which shows the total number of skips and failures as well as the number of each per hundred pupils in each group. From the data given in Table II we find that the total number of skips for boys in annual-promotion systems is 182. That is,

1 skip by 176 boys	= 176 skips
2 skips by 3 boys	= 6 skips
Total number	= 182 skips

This represents 1.43 skips per hundred boys. By a similar method of combining the data given in Table II, we may determine the number of failures:

1 failure made by 2,391 boys	= 2,391 failures
2 failures made by 470 boys	= 940 failures
3 failures made by 100 boys	= 300 failures
4 failures made by 22 boys	= 88 failures
5 failures made by 4 boys	= 20 failures
Total number	= 3,739 failures

This number of failures is the equivalent of 29.36 failures per hundred boys in annual-promotion systems.

In keeping with general observation and the results of other progress studies, it is clear from this table that the girls progress through the grades noticeably better than do the boys. In the

annual-promotion systems, 1 percent of the boys and 2 percent of the girls skipped (see Table II). As expressed for each group of one hundred pupils, the corresponding figures are 1.43 for the boys, and 1.82 for the girls, respectively (see Table III). In this group, 24 percent of the boys failed, but only 15 percent of the girls, which gives the girls a record that is 9 points better than that of the boys (see Table II). There are 29.36 of these failures to

TABLE III

SKIPS AND FAILURES PER ONE HUNDRED PUPILS

	Total Number of Pupils	Skips		Failures	
		Number	Number per 100 Pupils*	Number	Number per 100 Pupils*
(1)	(2)	(3)	(4)	(5)	(6)
	Annual Promotion				
Boys	12,735	182	1.43	3,739	29.36
Girls	12,383	225	1.82	2,196	17.73
Total	25,118	407	1.62	5,935	23.63
	Semiannual Promotion				
Boys	6,082	453	7.44	3,997	65.71
Girls	6,130	588	9.59	2,746	44.80
Total	12,212	1,041	8.52	6,743	55.22
	Both Systems of Promotion				
Boys	18,817	635	3.37	7,736	41.11
Girls	18,513	813	4.39	4,942	26.70
Total	37,330	1,448	3.88	12,678	33.96

each one hundred boys, and 17.73 failures to each one hundred girls (see Table III).

A similar situation is found in schools which are organized according to the semester system. Here, 6 percent of the boys and 8 percent of the girls skipped, which gives the girls an advantage of 2 percentage points (see Table II). Furthermore, there are 7.44 skips to each one hundred boys and 9.59 to each one hundred girls (see Table III). The figures on failures in the semiannual-promotion group are: 37 percent for the boys and 28 percent for the

girls, which show the latter to be almost 9 percentage points superior to the boys. There are 65.71 failures to each one hundred boys and 44.80 to each one hundred girls. These figures appear surprisingly large, but they are chiefly affected by the greater flexibility of promoting semiannually than annually.

A comparison of the effect of the two promotion plans as revealed in skipping and failing is possible by means of the data shown in Table II. In schools which promote annually, 2 percent of the children skipped, while in the schools which promote each semester 7 percent of the pupils skipped. Nineteen percent of the children in the former system failed, and 32 percent of those in the latter. This condition should not be interpreted literally on account of the different amounts of time between promotions. The greater flexibility of the semester-promotion plan is also shown by the fact that under such a plan there are 8.52 skips and 55.22 failures to each one hundred children, while under the yearly promotion plan there are only 1.62 skips and 23.63 failures for each group of one hundred. This means that there are 14.8 times more failures than accelerations in the annual-promotion schools, and only 6.5 times more failures than accelerations in the schools organized on a semester basis.[2]

The advantage of promotion by semesters lies in the fact that it allows a greater number of pupils to progress faster than does the annual promotion. The total amount of time involved, or the semesters gained, may be somewhat greater in the annual-promotion schools, but this advantage is more than offset because fewer children progress. On the other hand, more pupils are retarded in the schools which promote semiannually than in those promoting annually. However, in the former a child is retarded but one-half year as compared to a whole year in the latter. It seems, therefore, that the superior flexibility of the semiannual promotions is established.

That a failure, or even several failures, did not necessarily keep the same child from skipping is a fact worth noting. In the schools

[2] The reader is cautioned not to make a direct comparison of the progress made by the two promotion systems. The unit of skipping or failing in the annual-promotion systems is one year and in the semiannual-promotion systems is one-half year. The main interest here is in flexibility by acceleration of the superior pupils and the retardation of the inferior pupils.

having annual promotion, 2,391 boys failed once but 21 of them also skipped once. This is almost one in each one hundred, or .88 percent. Of the 1,553 girls who failed once 10, or .64 percent, skipped once. In the semi-annual promotion schools, four boys and five girls in each hundred who failed once also skipped once. In both systems boys and girls were found who skipped one or more grades in spite of more than one failure.

GRADES IN WHICH THE IRREGULARITIES OF PROMOTION OCCUR

The second part of this study deals with the problem of the grade in which these accelerations and failures took place. To get this information it was necessary to calculate the skips and failures for the pupils of each grade. In locating these irregularities of promotion the interest was centered not on the number of skips and failures accumulated by the particular group of children belonging to a certain grade, but on the number of these irregularities which each grade accumulated from the children in Grades I through VIII at the time of this investigation.

TABLE IV

GRADE LOCATION OF FAILURES ACCUMULATED BY GRADES I TO VIII IN ANNUAL-PROMOTION SCHOOL SYSTEMS

Present Grade (Spring, 1926)	Grades in Which Failures Accrued							
	I	II	III	IV	V	VI	VII	VIII
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Grade I	434	.....	.....	.....	.....	.....	.....	.....
Grade II	439	252	.....	.....	.....	.....	.....	.....
Grade III	363	243	200	.....	.....	.....	.....	.....
Grade IV	279	190	181	242	.....	.....	.....	.....
Grade V	225	133	179	184	193	.....	.....	.....
Grade VI	196	116	124	151	152	179	.....	.....
Grade VII	105	79	59	95	117	97	120	.....
Grade VIII	77	63	50	68	72	73	108	59
Total	2,118	1,076	793	740	534	349	228	59

Table IV gives by grades the location of the failures of the pupils in schools promoting annually. Of the pupils who were in Grade I at the time of this investigation, 434 failed in first grade; of those in Grade II, 439 failed in first grade and 252 failed in

second grade; of those in Grade III, 363 failed in first grade, 243 in second grade, and 200 in third grade. It is evident, therefore, that Grade I has had the opportunity to accumulate eight times as many failures as Grade VIII; Grade II, seven times as many as Grade VIII; and so on. For this reason it is necessary to weight the failures of the various grades by dividing the number of failures that the first grade has accumulated by 8, the number that the second grade has accumulated by 7; etc. The procedure is shown in Table V. It should be noted, however, that the records of Grade VIII in the annual-promotion systems and Grade VIII-A

TABLE V

PERCENT OF FAILURES PER GRADE IN SCHOOLS HAVING ANNUAL PROMOTIONS

	Number of Failures	Divided by	Equals	Percent
(1)	(2)	(3)	(4)	(5)
Grade I	2,118	8	264.75	23.59
Grade II	1,076	7	153.71	13.71
Grade III	793	6	132.17	11.79
Grade IV	740	5	148.00	13.20
Grade V	534	4	133.50	11.90
Grade VI	349	3	116.33	10.37
Grade VII	228	2	114.00	10.17
Grade VIII	59	1	59.00	5.26
Total	5,897	.....	1,121.46	.....

in the semester-promotion schools would be complete only when the pupils who were doing work in these grades at the time of this study had passed through them.

Tables VI and VII give the percentage distributions of the skips and failures in the elementary schools of Iowa. The percents for these tables were derived by the method shown in Table V. At the beginning of a child's school career the possibility of failure is apparently most threatening. In the annual systems of promotion this means Grade I, that is, the whole first year. In the semiannual systems it means practically the same. The difference is small enough to be disregarded, and it may be explained by the fact that the girls in the semiannual schools have a higher percent

of their failures in Grade I-B (20 percent) than do the boys (18 percent), and thus having been sorted out a little more carefully they go along after I-A somewhat smoother for a while. and their next high percent of failures occurs in Grade IV-B. By the time they reach Grade IV-A the percent of failures is even for both boys and girls.

Where the pupils are promoted annually (see Table VI), the girls again show a higher percent of their failures in Grade I (25 percent) than do the boys (23 percent). After Grade III, however, the percents are practically identical. One contributing factor to the high percent of the total number of non-promotions in

TABLE VI

GRADE LOCATION OF SKIPS AND FAILURES IN ANNUAL-PROMOTION SYSTEMS

	PERCENT OF TOTAL SKIPS			PERCENT OF TOTAL FAILURES		
	Boys	Girls	Both	Boys	Girls	Both
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Grade I	14	13	13	23	25	24
Grade II	31	32	32	15	12	14
Grade III	23	23	23	12	12	12
Grade IV	13	13	13	13	14	13
Grade V	12	14	13	12	12	12
Grade VI	3	2	2	10	10	10
Grade VII	3	3	3	10	10	10
Grade VIII	.....	.....	.....	5	6	5

the beginning of the children's school career in Iowa is no doubt the early entrance into first grade. An age-grade table based on these same records shows that, in Grade I, 49 percent of those in the school systems having annual promotion and 46 percent in those having the semiannual promotion are five years old or less.

The greatest percentage of failures, as shown in the data for both sexes, tends to be in Grade I in the annual-promotion schools and in Grade I-B in the semiannual. An abrupt drop takes place in Grade II for the former schools and in I-A for the latter. The annual-promotion schools have a slight rise in Grade IV and then drop slowly again. The semester-promotion schools show a very small increase in Grade IV-B, and from that point on the number

of failures decreases slowly but steadily. The gradual decrease in failures from the lower to the higher grades in both promotion systems is what might be expected as the result of elimination taking its toll of the less fit from year to year.

The skipping process is at its highest after the children have been in school one year. It may be that the selection, that is, the

TABLE VII

GRADE LOCATION OF SKIPS AND FAILURES IN SEMIANNUAL-PROMOTION SYSTEMS

	PERCENT OF TOTAL SKIPS			PERCENT OF TOTAL FAILURES		
	Boys	Girls	Both	Boys	Girls	Both
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Grade I-B	4	4	4	18	20	19
Grade I-A	9	10	10	9	8	9
Grade II-B	15	17	16	7	6	7
Grade II-A	10	14	12	5	4	5
Grade III-B	11	10	10	6	6	6
Grade III-A	9	10	10	5	6	6
Grade IV-B	7	5	6	7	8	8
Grade IV-A	8	8	8	6	6	6
Grade V-B	6	4	5	7	7	7
Grade V-A	8	9	8	5	5	5
Grade VI-B	5	6	5	5	6	6
Grade VI-A	4	3	4	4	3	
Grade VII-B	1	1	1	3	3	
Grade VII-A	2	.....	1	4	4	4
Grade VIII-B	.....	.....	.....	5	3	4
Grade VIII-A	.....	.....	.....	3	3	3

high percent of failures which is found in Grade I, leaves that as an after effect. Thirty-two percent of all the accelerations in schools promoting annually are in the second grade, and 16 percent of them in the semester-promotion schools are in II-B. The same tendency to decrease, as was evident in failures, also appears in skips as the children pass from lower to higher grades.

The progress of children in Grade VIII at the time of this investigation who had continued in their present school system since

they entered Grade I was also calculated, in order to validate the method used for obtaining the results relative to accelerations and failures for all children in the public elementary schools of the state. This is a somewhat selected group of children. Tables were set up revealing practically the same situation as is shown in Tables VI and VII.

The data presented in this article reveal a need for a more exact conception of what is meant by the progress of pupils. Progress which is apparently normal may be free from irregularity, or it may be the result of a balanced irregularity. Girls make more regular progress than do boys although the reasons are not all evident. The effect of the type of promotion is revealed concretely in terms of the relation between failures and double promotions. There are 14.8 times as many failures as double promotions in annual-promotion schools while there are only 6.5 times as many in schools promoting on the semester basis. Failure does not preclude double promotion for the same child—between four and five pupils per hundred who fail once also skip once.

The beginning of a child's school career is naturally the most dangerous for him as far as failure is concerned. The spot of greatest frequency of failure is Grade I for both boys and girls while the optimum spot for skipping is the second grade. This conclusion is supported by data from all grades or from eighth-grade pupils who have had all their training in the same school system.

A COMPARISON BETWEEN SCHOOL ATTENDANCE AND SCHOOL COSTS

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MUCH has been written on the problem of school costs. Good presentations have been given by Ayres and Burgess, but the data considered in their reports go only as far as 1918. This article brings certain of the tables which are significant through 1924. The sources for the figures used are similar to those employed for the indexes of the earlier years. Practically all of the data for these figures are found in the "Biennial Reports of the United States Bureau of Education."

TABLE I

INDEX NUMBERS FOR THE YEARS 1920, 1922, 1924, COMPUTED ACCORDING TO AYRES'S METHOD

Items Used by Ayres*	1920	1922	1924
(1)	(2)	(3)	(4)
Percent of school population attending school daily	58.24	64.39	65.20
Average days attended by each child of school age	47.15	53.00	54.80
Average number of days schools were kept open	80.95	82.00	84.15
Percent that high-school attendance was of total attendance	40.86	46.76	53.15
Percent that boys were of girls in high schools	82.20	88.84	89.18
Average expenditure per child attending	64.16	85.76	95.17
Average expenditure per child of school age	37.37	55.22	62.04
Average expenditure per teacher employed	63.53	91.10	99.65
Expenditure per pupil for purposes other than teachers' salaries	52.35	75.43	88.09
Expenditure per teacher for salaries	72.58	97.17	102.25
Index	59.94	73.97	79.37

*Ayres, Leonard P. *Op. cit.*, p. 21.

Ayres's index number was composed of ten items, five of which had to do with attendance and five with school costs. These items are listed in the stub of Table I. In determining the index numbers

for the years 1920, 1922, and 1924, the appropriate figures taken from the "Biennial Reports of the United States Bureau of Education" were used. To be sure that the correct sets of figures were being employed, Ayres's index numbers for several of the previous years were computed also. The index numbers for the years 1920, 1922, and 1924 are given in Table I.

The figures taken from the biennial reports, of course, are weighted the same as in Ayres's study.[1] Every item has consistently increased, and the surprising feature is the large amount of

TABLE II

FIGURES USED IN THE COMPARISON BETWEEN SCHOOL ATTENDANCE AND SCHOOL COSTS

Year	Total Population	Average Daily Attendance	Total Expenditures	Pupils Enrolled in Public High Schools
(1)	(2)	(3)	(4)	(5)
1870.....	38,558,371	4,077,347	$ 63,396,666	80,227
1880.....	50,155,783	6,144,143	78,094,687	110,277
1890.....	62,622,250	8,153,635	140,506,715	202,963
1895.....	68,844,341	9,548,722	175,809,279	350,099
1900.....	75,602,515	10,632,772	214,964,618	519,251
1905.....	82,584,061	11,481,531	291,616,660	679,702
1910.....	91,972,266	12,827,307	426,250,434	915,061
1915.....	100,399,318	14,985,900	605,460,785	1,328,984
1918.....	105,253,300	15,548,914	763,678,089	1,645,171
1920.....	105,710,620	16,150,035	1,036,151,209	2,199,389
1922.....	109,248,393	18,432,213	1,580,671,296	2,873,009
1924.....	112,078,611	19,132,191	1,820,743,936	3,389,878

increase within the last few years. This can be seen more clearly in Figure 1, which is a graph of the index numbers. The items selected by Ayres were those in which an increase would tend, in general, toward better education. Ayres shows a correlation of .78 between the five attendance items and the five financial items. From Figure 1 it will be seen that within the last six years the biennial index numbers have increased more than during the entire period covered by Ayres's study.

[1] Ayres, Leonard P. *An Index Number for State School Systems.* New York, Russell Sage Foundation, 1920. p. 16 ff.

From the figures given in Table II, a direct comparison may be made between increasing school attendance and school costs. The information contained in Table II may be summarized in the following statements:

1. The population of the United States in 1924 was about three times as great as it was in 1870.
2. There were almost five times as many pupils in school as in 1870.
3. School costs were almost twenty-nine times as great.
4. There were about forty-two times as many high-school pupils as in 1870.

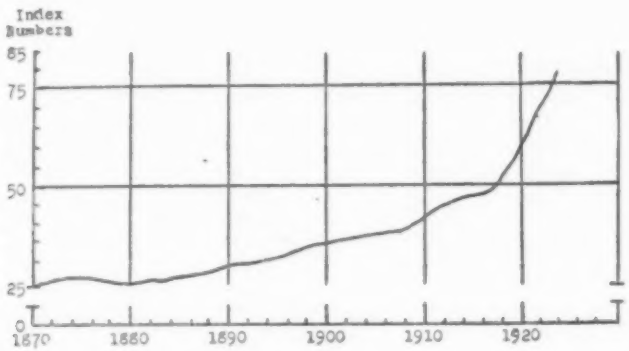

Figure 1. Index numbers from 1870 to 1924

5. The third and fourth items show accelerated increases as compared with the constant increases of the first and second items.
6. In education, as expenditures increase they are, in general, accompanied by increased efficiency and greater attendance, and vice versa. That is, the coefficient of correlation between the two is high.

Figure 2, in which the population figures for the decades since 1870 are plotted, and Figure 3, which shows the numbers in average daily attendance over the same period, both indicate practically constant increases, while the curves of Figure 4, total expenditure, and Figure 5, high-school attendance, show a decidedly accelerated increase. This means briefly that costs and high-school attendance are growing much more rapidly than the entire school attendance or population. It means further that although costs are increasing

more rapidly than school attendance in general, yet the very part of the school population for which the costs are highest—the high school—is likewise increasing more rapidly. A recent report of the Commissioner of Education states, "It costs approximately two

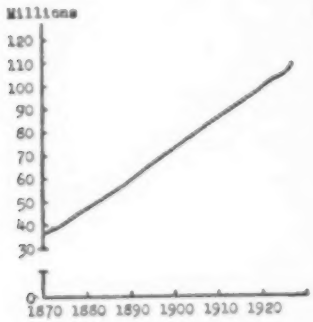

Figure 2. Total population

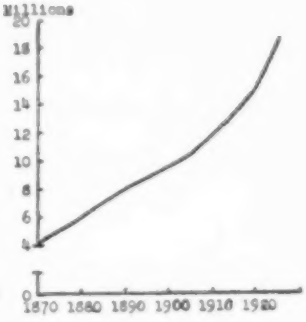

Figure 3. Average daily attendance

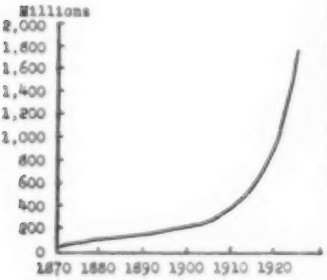

Figure 4. Total expenditure

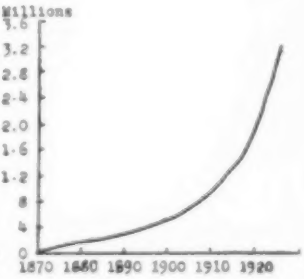

Figure 5. High-school attendance

and one-half times as much to educate pupils attending high schools as pupils attending elementary schools."[2]

Many factors enter into the increase in school costs. The National Education Association gives the following principal factors: the rapid increase in school attendance, particularly in the upper and more expensive grades; the depreciation in the purchasing

[2] Swift, Fletcher H. *A Biennial Survey of Public School Finance in the United States, 1920-1922.* Washington, D. C., Government Printing Office, 1923. p. 5. (Bureau of Education Bulletin, 1923, No. 47)

power of the dollar; and the increase in the amount, the kinds, and the quality of service demanded by society.[3]

In addition to these three factors which he also includes in his list, Burris gives two more causes: the increase in length of school term and the erection of new buildings.[4] Whatever the causes may be, the increase in school costs is a real and vital problem, and one to which more and more attention will have to be given. Indeed, any discussion of problems in secondary education is not complete unless careful attention be given to increasing school costs.

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[3] "Major Issues in School Finance, Part I," *Research Bulletin of the National Education Association*, 4:249, November, 1926.

[4] Burris, Benjamin J. *Costs of Instruction in Indiana High Schools.* Indianapolis, Indiana, State Department of Public Instruction, 1924. p. 3. (Bulletin No. 71)

DIFFICULT WORDS AND THE BEGINNER

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EVERY first-grade teacher is faced with the problem of teaching her pupils to recognize printed words as one of the first steps in the reading process. Each child must be led to recognize the visual symbol for each word and to associate it with the proper meaning. While many pupils find this a most difficult task, practically nothing is known concerning many of the factors conditioning the process.

The present experiment was instituted to study factors which condition the acquiring of a reading vocabulary by first-grade children, because during several preliminary investigations great variability had been found in the learning difficulty of the various words. Since this is essentially a classroom problem which every first-grade teacher must face, no attempt was made to conduct a laboratory experiment. Every effort was made to standardize the classroom procedure in the belief that if the difficulty were inherent in the word itself, it would become evident when the children's ability to recognize the word was tested.

The children, fifty-six in number, were given the Binet test and paired as nearly as possible according to their chronological and mental ages. They were then placed in two rooms under teachers who were judged to be of similar ability and who had taught in the same school for a number of years.

Textbooks adopted by the county were used, and the words studied were the first sixty in the text. The experiment was explained to the teachers and the following program of action was adopted: (1) Each new word was to be developed at a separate period, and three new words were to be taught each day for four days. Friday of each week was used for review and for testing. The teachers were not limited as to the method of teaching, but they were urged to teach each word so that it would make the deepest possible impression. In general, the effect was to cause the teachers to put more than the usual amount of emphasis upon word-recognition. This emphasis was evident during the reading

periods as well as during the teaching of the words and during the drill periods. (2) After the word had been presented, it was added to the flash-card list and kept there for five days. A fifteen-minute drill was given each day on the flash cards. (3) Two twenty-minute reading periods were held each day with the regular chart material and the primers.

Every Friday morning for twelve weeks the children were tested individually with flash cards; and when a word was miscalled, the wrong response was written down, on the back of the card, opposite the pupil's number and under the proper week. Each word was presented to the pupils for five weeks. This gave two different records. First, there was the learning record of each child for sixty words; and, second, the record showing the difficulty which the children had with each word and the various words with which it was confused. The testing was done during the class hours, and the teacher continued her regular work while the author was testing.

In Table I, which will be found toward the end of this report, the words have been arranged according to difficulty as measured by the inability of children to recognize them when they are presented on flash cards. In passing it may be of interest to note that, on the average, 33 percent of the words were miscalled at the end of the first week of teaching, and that 10 percent were not correctly recognized at the end of five weeks of teaching. Each card was presented 250 times in the course of five weeks. The number of times the word was miscalled during that period is shown in Column 2.

The first glance at this arrangement of words will suggest no reason for the difficulty met by these children. Length of word is quite evidently not the cause. An average of 49 mistakes was made for each of the two-letter words and of 51 mistakes for the three-letter words. The four-letter words averaged only 42 mistakes each while the five-, six-, and seven-letter words averaged 28, 25, and 15 mistakes each. As far as this list of words is concerned, therefore, length of word is a help in learning. This is just the opposite of Gates's conclusions on the learning of words.[1] When

[1] Gates, Arthur I., and Boeker, Eloise. "A Study of Initial Stages in Reading by Pre-School Children," *Teachers College Record*, 24:472-74, November, 1923.

the list is examined again, it will be seen that the average figures conceal many exceptions since some of the short words are easy to learn and some of the long words are hard to learn. These facts would tend to show that the length of a word is not an important factor in learning difficulty.

Ever since Thorndike's remarkable word list appeared, it has been used as the source from which authors have drawn words for their primers and first readers. In the description of almost any modern series of readers, can be found a statement claiming that a high percent of the words in the vocabulary comes from the first thousand words in Thorndike's list.

As far as the present list of words is concerned, frequency in the Thorndike list means difficulty of learning. This study showed a correlation of $-.20 \pm .08$ between frequency on the Thorndike list and ease of learning. This correlation is so low as to be without much value, but it certainly gives no justification for an indiscriminate use of the Thorndike list as the source for first-grade words. It is generally recognized that Thorndike's list gives the relative utility of any word in question. The standard of utility used, however, is largely an adult standard, for most of the words were drawn from adult literature.

It is entirely possible that a given word may be very useful to an adult and have little meaning to a child. The reverse of this also may be true. The word *tricycle* occurs in the tenth thousand of the Thorndike list and does not occur at all in the Gates list, yet it is a word around which much of the life experience of a child may cluster. There is a constant tendency to confuse the psychological process of the child with those of the adult. W. H. Winch, in the report of his studies of children who are learning to read, warns against what he calls the "diminished-adult view of the child mind." "Our own psychological processes," he says, "are put into the child, diminished in strength but similar in form."[2] The diminished adult view of the child mind is evident when an adult vocabulary is made the basis for the selection of a vocabulary for children.

[2] *Teaching Beginners to Read in England: Its Methods, Results, and Psychological Bases.* Bloomington, Illinois, Public School Publishing Company 1925. p. 9. (Journal of Educational Research Monograph, No. 8)

Arthur I. Gates has recently published a Reading Vocabulary for the Primary Grades consisting of fifteen hundred words. This vocabulary is an attempted improvement on the Thorndike list although the first twenty-five hundred words contained in this list are used as one of the sources. The words are ranked in order of merit from one to fifteen hundred on the basis of expert judgment and on the basis of frequency in the literature and spoken language of children. All of the sixty words used in this experiment occur in his list, and all but three of them occur among the first five hundred words. Nevertheless, the ease of learning of the sixty words used in this test and the ratings given on the Gates list correlate .21 $\pm$.08. It would seem, therefore, that as far as this list of sixty words is concerned, Gates's list improves but little upon Thorndike's list. Evidently, the criteria used by Gates do not get at the root of the difficulty which children experience in learning the words.

More and more attention is being given to the spoken vocabulary of children; and this, without question, is a hopeful sign. The value of a word in the vocabulary of a given grade depends upon the meanings or associations which cluster about that word in the mind of the child who is to use it.

In the third column of Table I are listed the words which were given by the children when the word on the flash card was shown. The frequency with which certain words seem to be confused with other words is the first thing that will be noticed. For instance, the word *dog* was given 31 times when the word *girl* was presented. On the average, 28 percent of the errors are due to confusing a given word with some other one word.

A study of the results in Column 3 will show that children attempt to employ aids to recognition. The cues they attempt to use, however, are often incomplete, and confusion with other words results. Lois Hayden Meek, in a recent study made at Columbia University, concludes that "children did, deliberately or accidentally, hit upon certain letters or groups of letters for means of identification of words." She also found that incomplete cues were often responsible for confusion with other words.[3]

[3] *A Study of Learning and Retention in Young Children.* New York, Teachers College, Columbia University, 1925. pp. 58-59. (Teachers College, Columbia University, Contributions to Education, No. 164)

The last column of Table I lists the configuration confusions that occurred with each of the given words. Four types occur which are (1) confusions due to similar beginnings, (2) confusions due to similar endings, (3) confusions due to similar middles, and (4) confusions due to an ending of one word being similar to the beginning of another word.

The first type is that marked *b*, where the confusion seems to occur because both words begin with the same letter or the same two letters. The word *can* is a good example of this as it was confused 26 times with the word *cat*. Often, both the first and last letter were similar as when *run* was the response 18 times instead of the given word *rain*. In such cases, the configuration was arbitrarily listed as a beginning confusion.

The second type of confusion occurred when both the given word and the wrong response ended in the same letter or the same two letters. The word *sat* was called *cat* 21 times. These confusions are marked *e*.

A small amount of confusion also seemed to occur because of similar letters within the words. This, the third type of confusion, is marked *m*.

A most interesting type of confusion, the fourth, called *r*, is illustrated best by the confusion that occurred between *girl* and *dog*. Here the beginning letter of one word is the same as the ending letter of the other word. This reverse type of confusion is far more common than might be supposed and accounts for 273 errors in this experiment, but it is not mentioned in any of the literature available to the author. The confusions caused by similar beginnings caused 490 errors, although it must be remembered that several errors were classified *b* which might also have been classified *e*. Similarity of endings accounted for 479 of the errors, and similarity of middle letters accounted for only 59 errors.

The possibility that chance is responsible for a large part of this similarity is ruled out by the following facts. It has already been pointed out that an average of 28 percent of all the mistakes occur between a given word and one word with which it is confused. Again the children gave very few words that had not been taught to them during the experiment. These words, marked "miscellaneous," account for but a small percent of the total number of

errors. The children seemed to be bound by a certain mental set which was tipped off by a slight cue. In many cases, these cues proved to be inadequate.

When the number of confusions traceable to configuration are correlated with the total number of mistakes in recognition the coefficient of correlation is found to be $.86 \pm .02$. Thus, a high correlation would indicate that a large amount of the difficulty encountered by the beginner is due to configuration confusions. It will now be possible for the author of a reader to study his vocabulary and present the new words in such sequence that the pupil will learn each word before a word of similar configuration is presented. Likewise, the teacher can be on her guard to prevent the formation of wrong associations between the word symbol and the spoken word. Children formed just such incorrect associations in many cases and, consequently, in this experiment some gave the same incorrect response every week for five weeks.

Configuration confusions, however, are difficulties that do not necessarily inhere in the words themselves. From the earlier experiments it was decided that there must be something about the content of the word itself that influenced the learning difficulty. Bowden found, in an analytical study of errors in recognition, that nouns and adjectives were more quickly learned than were the other parts of speech. A glance at Column 2 will show that the same conclusion can be drawn from the present study, as far as the nouns are concerned. It will also be noted that some nouns are much easier to learn than others.

It was therefore thought advisable to give the pupils in this experiment a test to determine how rich in associations the sixty words were that were to be used in the experiment. This test was given before any of the words had been taught.

Each child was first given an individual practice association test of ten words. The child was then told to play a game to find out how quickly a given word made him think of another word. When the child gave an answer that was apparently without meaning in response to the word given by the tester, he was cautioned to think first of what the given word meant. There was a tendency for some of the pupils to listen to the sound of the given word and then make up some word of their own or give a word that rhymed

with it. This tendency was carefully checked as the purpose of the test was to get the meaningful associations that the pupils had with the sixty words.

After the pupils had been given the preliminary training test of ten words, they were tested the following day on the sixty words used in this study. The responses of each child were recorded and also marked quick or slow according to the reaction time of the child. If given within three seconds after the stimulating word was pronounced by the tester, the response was marked quick.

Three children were eliminated from the experiment by this association test because it was impossible to get adequate responses from them. Two of them were of foreign parentage and the third was of low mentality. One of these pupils responded to everything in terms of ownership. "Dog? We no got dog," he would say. "Chicken? We got chicken."

The quick responses varied from 11 for the word *they* to 43 for the word *dinner*. Quickness of response is perhaps one of the best measures available for richness of association. Unless a word has meaning for the child, the response is labored and slow. This fact suggests that where the associations with a word are meager, the learning of the word symbol would also be difficult and slow. The results would bear out this hypothesis as the correlation between ease of learning and quickness of association is .55 $\pm$.06 (product-moment formula). This correlation is significant, for it concerns the difficulty inherent in the word itself. Unlike the configuration difficulty, the trouble that arises because a child has few associations with the word being taught cannot be removed by an author who is writing a primer. It is entirely possible also that the correlation given will be found to be greater when the configuration confusions have been decreased through a better organization of vocabulary. While it will relatively be a small task to secure a better arrangement of words from the standpoint of configuration, a great deal of research will be necessary before it is possible to say which words have the most meaning for children.

The fact that ease of learning seems to depend upon richness of association may also explain why there is not a better correlation between frequency in the word list of Thorndike or Gates and the ease of learning. Sixty words may not be a sufficiently

large sampling upon which to draw conclusions regarding the usefulness of these word lists in the primary grades. However, all the data of this experiment would indicate that in the preparation of those lists too much emphasis has been placed upon the utility of the words as measured by adult standards.

CONCLUSIONS

From this study it would be safe to conclude that the meaning which a word has for a first-grade child is a factor which will greatly influence the difficulty he may have in learning to recognize the word symbol. This being true, more attention should be given to this factor in selecting vocabularies for first-grade children. Children, accidentally or deliberately, make use of cues in their attempt to recognize new words. These cues are often inadequate and confusion with similar words occurs. This type of configuration confusion and the resultant difficulty could be greatly lessened by a more careful selection and arrangement of words in the vocabulary being taught. Inclusion of a word in the spoken vocabulary of children, in children's literature, or in any of the present word lists does not seem to be an adequate measure of the learning difficulty of the word.

TABLE I

WORDS GIVEN IN THE TEST AND THOSE WITH WHICH THEY WERE CONFUSED

	Mistakes in Recognition	Words with Which It Was Confused[a]	Configuration Confusion
(1)	(2)	(3)	(4)
eggs	1	rabbits (1)	1-e
milk	6	like (3), little (2), yes (1)	1-m
to	9	I (1), girl (1), house (1), bird (1), miscellaneous (4)	0
mouse	10	mother (5), rat (3), said (1), we (1)	5-b, 1-e
rabbits	12	kittens (4), dinner (2), mother (2), the (1), eggs (1), yes (1), garden (1)	5-e, 4-r
boy	13	dog (3), the (2), fly (2), mother (1), bird (1)	3-e, 1-b
		away (1), not (1), you (1), go (1)	4-m, 1-r
barn	15	said (3), play (3), dinner (2), sat (2), the (1), dove (1), they (1), milk (1), my (1)	3-m
kittens	17	rabbits (5), like (2), find (1), the (1), little (1), it (1), cat (1), white (1), said (1), will (1), dinner (1), mouse (1)	5-e, 1-m

TABLE I—*Continued*

	Mistakes in Recognition	Words with Which It Was Confused	Configuration Confusion
(1)	(2)	(3)	(4)
run	18	find (4), rain (3), mother (3), girl (1), boy (1), the (1), father (1), house (1), bird (1), rabbits (1), miscellaneous (1)	3-e, 4-r
garden	19	dinner (6), gave (3), rabbits (3), it (1), father (1), dog (1), cow (1), and (1), eggs (1), miscellaneous (1)	3-b, 1-r
bird	21	the (3), mother (2), boy (2), father (2), tree (2), sing (2), house (1), saw (1), to (1), me (1), is (1), like (1), cat (1), girl (1)	2-b, 1-m
will	22	is (5), they (3), little (2), me (2), give (2), find (1), the (1), away (1), in (1), like (1), it (1), we (1), do (1)	1-b, 1-r
mother	23	house (8), father (4), girl (2), good (2), man (1), home (1), mouse (1), dinner (1), are (1), is (1), saw (1)	2-b, 4-e
father	27	house (11), the (3), mother (2), find (2), tree (2), girl (1), jump (1), dog (1), nest (1), eggs (1), said (1), miscellaneous (1)	2-b, 2-e
not	27	nest (9), sat (4), to (2), it (2), no (3), wet (2), yes (1), will (1), said (1), hen (1), miscellaneous (1)	12-b, 3-r 8-e
sheep	27	dove (7), mother (3), the (2), she (2), miscellaneous (2), boy (1), tree (1), house (1), saw (1), bird (1), see (1), hen (1), cow (1), eggs (1), white (1), play (1)	3-b
fly	30	boy (8), flew (6), find (4), the (2), away (2), mother (1), to (1), like (1), it (1), cat (1), said (1), miscellaneous (2)	10-b 10-e
little	28	like (8), miscellaneous (4), me (3), boy (2), is (2), good (1), milk (1), girl (1), find (1), the (1), tree (1), it (1), see (1), eggs (1)	8-b, 6-e 1-m
dog	28	girl (20), eggs (3), boy (2), yes (1), is (1), find (1)	20-r, 2-m
do	28	go (14), to (2), it (2), miscellaneous (2), is (1), come (1), and (1), give (1), will (1), said (1), dog (1), like (1)	1-b, 16-e 1-r
dove	29	sheep (5), hen (3), is (3), boy (2), the (2), cow, (2) nest (2), she (2), in (1), bird (1), it (1), dog (1), sat (1), white (1), said (1), and (1)	1-b, 4-e 1-r, 5-m
cow	30	saw (9), cat (6), can (3), girl (2), is (2), find (1), in (1), see (1), away (1), sheep (1), dove (1), white (1), said (1)	9-b, 9-e 1-r, 1-m
dinner	30	kittens (6), barn (5), sheep (4), dove (3), mouse (2), jump (2), the (1), bird (1), it (1), they (1), white (1), play (1), milk (1)	3-b, 1-r
tree	31	the (7), bird (6), mother (2), father (2), run (2), cat (2), girl (1), boy (1), house (1), to (1), see (1), is (1), it (1), dog (1), nest (1), miscellaneous (1)	8-b, 1-e 4-r
white	35	saw (4), the (4), house (4), away (4), little (2), it (2), she (2), said (2), miscellaneous (2), father (1), see (1), is (1), hen (1), cow (1), dove (1), are (1), flew (1), mouse (1)	14-e 5-r, 1-m
saw	39	see (5), the (5), away (4), boy (3), girl (2), find (2), to (2), run (2), white (2), flew (2), you (2), father (1), tree (1), bird (1), yes (1), we (1), my (1), three (1), miscellaneous (1)	5-b, 2-e 3-r

TABLE I—*Continued*

	Mistakes in Recognition	Words with Which It Was Confused[a]	Configuration Confusion
(1)	(2)	(3)	(4)
play	38	boy (3), fly (3), sheep (3), you (3), wet (3), may (4), away (2), dove (2), miscellaneous (2), girl (1), little (1), like (1), are (1), we (1), they (1), sat (1), white (1), said (1), do (1), will (1), give (1), my (1)	14 e 3-r, 2-m
jump	39	dinner (10), sheep (6), rain (3), kittens (3), miscellaneous (3), barn (2), garden (2), boy (1), run (1), is (1), dove (1), sat (1), yes (1), wet (1), play (1), and (1), milk (1)	6-e, 1-r
girl	40	dog (31), the (3), eggs (2), boy (1), bird (1), cat (1), said (1)	31-r, 2-m
house	40	mother (12), the (3), girl (2), find (2), tree (2), saw (2), is (2), mouse (2), boy (1), father (1), to (1), little (1), fly (1), run (1), away (1), like (1), hen (1), dove (1), three (1), sing (1), miscellaneous (1)	1-b, 11-e
are	42	sat (7), tree (4), is (4), saw (3), said (3), in (2), me (2), cat (2), we (2), boy (1), the (1), father (1), bird (1), little (1), run (1), it (1), was (1), wet (1), may (1), miscellaneous (3)	9-e, 1-m
hen	45	house[a] (17), the (6), nest (6), is (2), they (2), said (2), girl (1), boy (1), me (1), away (1), sheep (1), eggs (1), sat (1), barn (1), can (1), miscellaneous (1)	17-b, 2-e 6-r, 1-m
my	45	may (13), me (10), they (4), boy (3), fly (2), we (2), the (1), in (1), see (1), is (1), sat (1), will (1), yes (1), you (1), wet (1), milk (1), miscellaneous (1)	24-b, 9-e 2-r
find	46	the (7), bird (5), little (4), they (3), mother (2), girl (2), father (2), saw (2), to (2), fly (2), run (2), said (2), tree (1), is (1), hen (1), nest (1), are (1), eggs (1), go (1), sing (1), walk (1), miscellaneous (1)	4-b, 7-e
away	47	saw (7), the (7), boy (6), white (4), flew (3), mother (2), find (2), fly (2), see (2), girl (1), father (1), house (1), in (1), me (1), jump (1), is (1), sheep (1), they (1), sat (1), yes (1), wet (1)	9-e, 1-r
cat	47	cow (9), sat (7), saw (4), can (9), is (3), house (2), see (2), miscellaneous (2), girl (1), find (1), father (1), tree (1), away (1), it (1), said (1), we (1), wet (1)	18-b, 9-e 1-r, 2-m
wet	49	saw (11), it (4), is (3), they (3), said (3), rain (3), nest (2), sat (2), white (2), we (2), play (2), miscellaneous (2), mother (1), in (1), boy (1), to (1), fly (1), cat (1), are (1), you (1), go (1), and (1)	15-r, 4-b 9-e
go	50	do (9), away (5), is (4), no (4), give (3), they (3), it (3), in (2), eggs (2), good (2), miscellaneous (3), girl (1), see (1), cow (1), not (1), yes (1), you (1), wet (1), play (1), garden (1), can (1)	6-b, 13-e
it	52	is (9), the (8), in (6), to (6), miscellaneous (7), me (4), cat (2), girl (1), saw (1), little (1), see (1), like (1), are (1), not (1), we (1), go (1), three (1)	15-b, 3-e 15-r
and	53	said (16), are (5), barn (5), will (3) sat (3), find (3), miscellaneous (3), wet (2), the (1), saw (1), to (1), it (1), dove (1), they (1), white (1), not (1), we (1), you (1), play (1), may (1), can (1)	5-b, 19-e 1-r

TABLE I—*Continued*

	Mistakes in Recognition	Words with Which It Was Confused*	Configuration Confusion
(1)	(2)	(3)	(4)
may	53	my (14), they (6), play (5), me (4), away (4), run (3), you (3), and (3), said (2), boy (1), fly (1), jump (1), is (1), it (1), will (1), no (1), we (1), miscellaneous (1)	18-b 17-e, 3-r
we	53	me (8), yes (5), saw (4), go (4), the (3), in (3), will (3), see (2), is (2), they (2), white (2), said (2), wet (2), my (2), gave (2), do (1), rain (1), are (1), she (1), to (1), mother (1)	7-b, 13-e
rain	54	run (18), tree (3), are (3), go (3), in (2), fly (2), they (2), play (2), barn (2), find (1), the (1), saw (1), bird (1),me (1), is (1),it (1),cat (1),hen (1),cow(1),sat (1), said (1), flew (1), you (1), and (1), milk (1), gave (1)	18-b, 5-e 4-m
can	56	cat (26), cow (13), the (2), is (2), they (2), mother (1), fly (1), me (1), sheep (1), she (1), are (1), rain (1), go (1), may (1), milk (1), come (1)	40-b, 1-e
flew	58	fly (13), saw (6), white (6), will (5), away (4), wet (3), girl (2), are (2), rain (2), play (2), mother (1), boy (1), the (1), father (1), me (1), like (1), it (1), cat (1), dove, (1), she (1), sat (1), said (1), miscellaneous (1)	14-b, 6-e 11-r, 2-m
nest	59	the (8), tree (5), wet (5), hen (4), house (3), saw (3), is (3), see (2), away (2), cat (2), sat (2), play (2), miscellaneous (2), mother (1), boy (1), father (1), bird (1), to (1), fly (1), run (1), like (1), it (1), dove (1), not (1), come (1), me (4)	21-b, 10-e 14-r
like	60	little (21), milk (5), find (5), miscellaneous (5), the (3), will (3), is (3), me (2), hen (2), good (2), girl (1), boy (1), in (1), see (1), it (1), cat (1), said (1), go (1), can (1)	21-b, 6-e 8-m
is	62	see (13), in (12), it (12), to (7), the (5), me (4), find (2), saw (2), miscellaneous (2), are (1), said (1), you (1)	24-b 16-r
in	63	me (12), the (9), is (6), like (5), it (4), miscellaneous (8), to (3), find (2), little (2), away (2), girl (1), boy (1), tree (1), saw (1), run (1), are (1), said (1), we (1), milk (1), come (1)	10-b, 1-e
me	63	in (18), the (5), miscellaneous (5), see (4), is (4), they (4), we (4), mother (3), nest (2), you (2), rain (2), girl (1), find (1), to (1), bird (1), away (1), like (1), it (1), she (1), my (1), come (1)	4-b, 12-e
she	60	the (23), see (5), is (5), they (4), hen (3), sat (3), house (2), little (2), sheep (2), mother (1), saw (1), me (1), away (1), it (1), cat (1), dove (1), are (1), white (1), will (1), play (1)	11-b 26-e, 8-m
no	67	not (23), in (8), to (8), run (8), go (5), one (4), me (2), they (2), the (1), away (1), it (1), she (1), rain (1), do (1), miscellaneous (1)	23-b 14-e
you	68	boy (27), yes (12), they (5), me (3), the (2), said (2), we (2), go (2), play (2), girl (1), it (1), are (1), will (1), not (1), give (1), rain (1), wet (1), do (1), may (1), miscellaneous (1)	12-b 35-r, 4-m
give	69	girl (35), dog (7), you (4), gave (3), like (3), dove (3), they (2), eggs (2), miscellaneous (3), the (1), hen (1), are (1), will (1), play (1), do (1), can (1)	38-b 8-e, 7-r

TABLE I—*Continued*

(1)	Mistakes in Recognition (2)	Words with Which It Was Confused[a] (3)	Configuration Confusion (4)
the	69	house (9), girl (5), three (5), tree (5), is (4), boy (4), saw (3), me (3), see (3), she (3), find (2), little (2), run (2), cat (2), nest (2), mother (1), bird (1), away (1), like (1), it (1), hen (1), sat (1), said (1), we (1), you (1), ate (1), one (1)	22-e 1-m, 6-r
sat	75	cat (21), is (6), said (6), it (3), they (3), wet (3), can (3), the (2), not (2), miscellaneous (1), boy (1), tree (1), saw (1), little (1), see (1), like (1), dog (1), she (1), will (1), rain (1), you (1), rabbits (1), nest (1), are (1)	9-b, 40-e 13-r
said	76	and (9), sat (6), the (5), find (4), is (4), dove (4), they (4), bird (3), saw (2), fly (2), me (2), it (2), she (2), dinner (2), girl (1), father (1), in (1), little (1), see (1), away (1), jump (1), like (1), nest (1), are (1), eggs (1), white (1), give (1), yes (1), we (1), may (1), barn (1), come (1), can (1), miscellaneous (1), sheep (1)	15-b 16-e 12-r, 6-m
see	76	tree (39), she (6), is (5), saw (4), the (3), it (3), to (2), me (2), girl (1), in (1), fly (1), like (1), cat (1), nest (1), they (1), eggs (1), you (1), wet (1), miscellaneous (1)	10-b 45-e, 6-r
yes	77	you (18), boy (17), me (4), wet (4), they (3), said (3), play (3), may (3), fly (2), like (2), rain (2), do (2), girl (1), find (1), in (1), saw (1), little (1), see (1), away (1), is (1), dog (1), nest (1), are (1), will (1), we (1)	18-b 1-e, 31-r
they	92	the (19), white (7), flew (7), may (6), boy (6), away (5), is (5), find (3), me (3), are (3), play (3), girl (1), in (2), fly (2), hen (2), sat (2), said (2), father (1), like (1), it (1), sheep (1), dove (1), she (1), give (1), we (1), rain (1), you (1), wet (1), milk (1)	19-b 22-e, 4-r

[a]Number in parentheses indicates the number of times the confusion occurred.

EDITORIALS

CONCERNING TRANSFER

WHIPPLE in his preface to Rugg's monograph on Mental Discipline (1916) says in effect that the question of the transfer of training is the central problem of educational psychology. We have no desire to force this dictum upon Dr. Whipple in perpetuity. He may have changed his mind since 1916, either because of developments in educational psychology, or because the doctrine of transfer is no longer the problem it was, or because he does not worship consistency. Any of these reasons, including the last, would be reasonable and sufficient. So it is likely that if our esteemed associate were available at the moment, he would reject our opening sentence. We hasten, however, to state that we have quoted him not for the purpose of criticizing him but with the intention of agreeing with him—or, anyway, almost agreeing with him. You know, it just won't do to agree thoroughly with anybody or to give unqualified adherence to anything. This is the day of scientific doubt, of endless qualification, of suspended judgment. One must be forthright in nothing. One must protect one's self at all costs. A thing is never the greatest, but only "perhaps" the greatest. One may not state a fact, but only suggest it. One does not allow one's self to say that anything is, but only that it has a tendency to be. Accordingly, with only enough reservation to meet the standards of the day, we join with our associate editor in saying: "The problem of mental discipline, of determining under what conditions, by what methods and to what extent training received in a given line of mental activity spreads to other lines of mental activity, is acknowledged to be the central problem of educational psychology."

Most of the experiments regarding transfer have provided for the training of persons in one activity and have then sought to measure the performance of the same persons in another activity without training in the latter. For example, Winch trained pupils

by giving them practice in solving problems in arithmetic and then sought to measure their improvement in reasoning with other material than arithmetical problems. No training was given between the initial and the final test in this second field. Again, Bagley taught children to be neat in writing their arithmetic papers and then attempted to measure their improvement in neatness in spelling and language. No training in the writing of spelling, and language was given. When Ruediger repeated Bagley's experiment with some important modifications, he again sought to measure transfer by carefully avoiding the influence of direct practice in any but the primary function.

This avoidance of learning in the field in which transfer is being measured has been one of the principal items of method in experiments of the sort we are describing. Yet it is certain that there are many practical considerations which make it both difficult and undesirable to apply this principle. Why not actually train the subjects in the secondary function and measure the *saving* in time or repetitions? We recognize the validity of the *Ersparnismethode*—the saving method—in the investigation of memory. For example, we test the retention of a series of nonsense syllables that has once been learned not by seeing how many of the syllables can be repeated after an interval but rather by the saving in time or number of repetitions in relearning the series. Very likely not a single syllable of a given series may be remembered after an interval of a week. Yet it will be found that the series can be relearned much more easily than it was learned originally. This saving is taken as a measure of retention due to the initial learning.

Note how much greater the significance—the practical meaning—of the question of transfer becomes when we seek its effects not as absolute performance but as a saving in learning. As long as Winch fails to train his subjects in reasoning with non-arithmetical material, he fails to get a measure of all the "spread" from arithmetical material. Many children may be quite unable to reason successfully in the secondary field who could learn to do so easily after they have been trained in the primary field. This added ease of learning would be a measure of transfer. Again, if Bagley had introduced training not only in the primary field but also (subsequently and in comparison with a control group) in the

secondary field, he might have found a considerable spread from neatness in arithmetic to neatness in language or spelling. It is not merely conceivable, it is, in fact, highly probable that in many pupils a manifestation of greater neatness in writing language papers is just below the threshold ready to emerge with a little encouragement. As long as it remains below the threshold nothing happens, and the easy assumption is made that there is no transfer. Indeed, there is not, as transfer is usually measured. However, if the teacher of language makes but a very little effort, a pupil who has registered no improvement may suddenly say to himself, "I see it; it's like our arithmetic papers." Immediately a large improvement follows, and it follows *mainly because of the training with the arithmetic papers.*

It seems to us clear that transfer is greater than the investigators have shown. Much of it, however, is potential, subliminal. It is where our college mathematics has gone. Very likely we cannot now solve a triangle or plot a curve or sum a series. Yet we could learn these things again much more quickly than we did at first. Our college mathematics has not entirely vanished. It is merely below the threshold.

Practical teachers make constant use of transfer. For example, in primary arithmetic suppose that $4 + 8$ has been taught. Now, in column addition $14 + 8$, $24 + 8$, and other such combinations will be needed. On the one hand, the wise teacher does not assume that because a child knows $4 + 8$ he knows $14 + 8$ by the magic of transfer. It is pretty clear that $14 + 8$ will have to be taken care of. On the other hand, the primary teacher who "knows her onions" will realize that there is substantial transfer from $4 + 8$ to $14 + 8$. It is seldom enough to enable the child without help to respond with the correct answer, but it is enough to permit him to learn the new fact far more easily than he could if he had not already learned $4 + 8$. The secret of the process is to lead him to see the likeness between the new and the old fact. When he has done that he has discovered the bridge over which transfer passes.

In learning there are two factors: one is general, the other specific. The general factor is based on the fact of transfer. In virtue of it the learning, for example, of a whole series of number facts is partly accomplished when $4 + 8$ is learned. The specific

factor corresponds to the new learning which must be done, the learning *ad hoc*. It means, for example, that even after 4 + 8 has been learned, some additional attention must be given to each of the various related facts. Thus learning—and therefore teaching—always steers between total transfer and absence of transfer. As between two situations it is probable that neither complete transfer nor entire absence of transfer ever exists for all children. Teaching, therefore, must move between these two extremes. But the determination of the extent to which transfer from old learning may be relied upon, and the extent to which additional teaching is demanded, requires the exercise of fine professional judgment. This is art in teaching.

B. R. B.

NEWS and COMMUNICATIONS

Fletcher Harper Swift, of the School of Education, University of California, while enroute to attend the Department of Superintendence meeting in Boston, delivered lectures in Detroit, Michigan, Cleveland, Ohio, and Syracuse, New York.

H. H. Kirk, superintendent of schools at Faribault, Minnesota, reports that in his city the median is much above standard on the Stevenson Reasoning Test in Arithmetic. The grade average is four points above the norm which the author of the test had found for schools in general.

A study of individual teachers' marks by departments for six semesters from September, 1924, to June, 1927, has been made by the Department of Research of the New Trier Township High School, Kenilworth, Illinois. Departmental averages vary widely, with art the highest and Spanish the lowest. In general, vocational subjects receive marks above the school average, foreign languages, below.

The University of North Carolina has just published a report of the educational research in progress during 1926-27 (see Bulletin No. 247, Graduate School Series, No. 171). The material is arranged by departments under which a brief statement is given of research studies which are being conducted by members of the faculty and their students. Such a publication from each of our educational institutions would be exceedingly helpful to college men everywhere who are directing research work.

During the past year, the elementary public schools of Streator, Illinois, employed Miss Ruth Clendenen as grade supervisor. In order that her supervision might be based on definite information, a survey of Grades V through VIII was made and has been reported in a mimeographed bulletin. Superintendent Fisher, in the Foreword, expresses his own confidence in the value of the work. He says:

> If nothing else was done last year by Miss Clendenen but to put through the survey, the money put into her salary and into necessary material was as productive of good educational results as any dollars the Board spent. Indeed, the value of last year's survey becomes this year dynamic energy, improving the technique of teachers and adding to the educational progress being made by many children.

The State Department of Education in Ohio is attacking vigorously the problem of teacher training. A committee of leaders in the field from both state and private institutions has set up a series of major objectives for a

teacher-training program. Among these objectives are teacher selection, training as a state function, adequacy of training, unified professional program, and training as a cooperative enterprise. A number of subcommittees are being organized to carry on research on problems involved under these various objectives.

We have been familiar for some time with scales for rating handwriting. The same technique has now been applied to neatness in arithmetic by Knight and McClure in their Arithmetic Neatness Scale. The scale consists of ten samples of arithmetic work of varying degrees of legibility and neatness, the variations between successive samples being approximately equal. The chart is to be placed on the wall so that the children may rank their own papers. Grade norms are being established.

The Iowa General Information Test in American History consists of one hundred completion or recall items arranged in order of difficulty. The items were chosen by a comparison of three widely used textbooks in American history. The scales show high reliability ($r = .95$) and validity. The scoring is objective, and the same booklet may be used many times with only the slight additional expense of the dupli-use test sheets. The test is published by the Bureau of Educational Research and Service, of the University of Iowa.

An Art Ability Test, four parts of which have been received, is being developed and standardized by Dr. Luella W. Pressey, of the Department of Psychology, and Alma Jordan Knauber, lately of the Department of Fine Arts, of Ohio State University. Form A is to obtain certain general information and the personal traits of the individual, Form B is to test skill in drawing, Form D gauges artistic appreciation, and Form E tests the art knowledge of those taking the test. Those who are interested in the tests should communicate with one of the authors.

The Columbia Research Bureau Algebra Test is designed to provide high schools and colleges with a reliable and comparable measure of students' ability and achievement. There are two parts to the test: Part I covers the essential operations of first-year algebra, while Part II consists of twenty problems for each of which the pupil must make an equation before solving it. The problem is scored as to the correctness of both the equation and the solution. Pupils are found to make much lower scores on Part II than on Part I, even though the possible score in Part II is nearly double that of Part I, and many of the equations are actually easier. The World Book Company publishes all of the Columbia Research Bureau Tests.

An interesting article on "What Words Do Adults Misspell?" by Miss Grace Kramer, of the Baltimore Bureau of Research, is found in the January number of the *Baltimore Bulletin of Education*. The material was taken from such sources as letters, manuscripts, advertisements, and signs; and it involves a wide variety of vocational activities among the misspellers, a

majority of whom are high-school graduates. A considerable number of the words listed in the study appear in Dr. Horn's study of the ten thousand words most commonly used in writing.

A study of trends in high-school enrollments in North Dakota is reported in the February issue of *School of Education Record*. This gives a percentage distribution of subject-unit enrollments for odd-numbered years since 1907-8. An examination of the figures for the extreme years calls attention to the fact that in 1907-8 no pupils were reported as enrolled in physical training, whereas in the last year, 1925-26, 12.3 percent of the enrollments were in this subject. If this subject is disregarded, a considerable drop is noted in ancient and modern foreign language, mathematics, and fine arts; while a substantial increase appears in natural science, social science, practical arts, and commercial subjects.

The Techniques of Educational Research is the title of a bulletin by W. S. Monroe and M. D. Engelhardt (see University of Illinois Bulletin, No. 19, Bureau of Educational Research Bulletin, No. 38). Procedures in educational research are given in this study under the following chapter headings: "The Problem and Its Definition"; "Collecting Data, Analyzing, Organizing, and Summarizing Data"; and "Determining Conclusions, Reporting Educational Research." The various phases of the problems have been well analyzed into their constituent elements, each of which is illustrated by an annotated bibliography bearing on the particular problem involved. The bulletin should be of genuine help to beginners in the research field.

A recent number of the bulletin, *Teaching of Health and Physical Education*, issued by the Ohio State Department of Education, lists the following equipment as essential for the high-school gymnasium and playgrounds in the state: in the gymnasium—4 basket balls, one set of baskets, 2 volley balls, 2 volley-ball nets, 4 indoor baseballs, 2 indoor baseball bats, 2 sets of jump standards, and 8 gymnasium mats; and on the playground—4 soccer footballs, 3 footballs, 1 set of football goals, 4 playground baseballs, a space for the 50-, 75-, and 100-yard dash, a space for broad jump with take-off board and landing pit, and space for high jump with landing pit. The bulletin also contains a considerable amount of curricular material organized under grade groups.

The University of Minnesota has just completed a significant study on class-size, particularly with reference to that University, which is being published by the University of Minnesota Press. Dr. Earl Hudelson, speaking of the investigation says:

First we canvassed all of the faculty and a thousand students scattered through the various years to ascertain their attitudes toward class-size and their reasons therefor. The second part of our investigation was a study of trends in class-size in the University of Minnesota over the past several years, and the effect of small and large classes upon marks. Our experimental evi-

dence consists of 59 experiments involving 108 classes under 21 instructors in 11 departments in four colleges of the University. The relative instructional cost of large and small classes has been computed for one of the experiments. The complete report is in press and should be available about May 1.

ADDING UP OR DOWN: ANOTHER CONSIDERATION

In the December number of the JOURNAL OF EDUCATIONAL RESEARCH, Professor Buckingham reports the results of an experiment to determine "whether under controlled conditions children learn more quickly and more satisfactorily" by adding upward in column addition or by adding downward. On the whole, the results show downward addition to be the superior. The concluding paragraph of the article is: "Even as matters stand, we feel that the results strongly indicate the wisdom of teaching children to add downward. When the verdict at seven different centers is six to one in favor of this method it is nothing more than good management to follow the figures where they lead."[1]

It is this last paragraph that I wish to question. As I interpret Professor Buckingham's article and the earlier one,[2] the implication is that we should teach *either* upward addition *or* downward addition. To come at once to the point of my criticism, the thesis that I wish to present is that we should teach not *either* but *both*.

It may be urged—and justly—that my argument is an a priori one, but that is not necessarily a fatal defect. When we come finally to interpret or to apply the results of observation and experiment, we must of necessity go beyond bare facts. Though we may agree upon the fact that one process is more rapid than another, we may hold radically divergent views as to what should be done about it.

With scarcely more than mere mention I shall pass by the interesting suggestion of one of my colleagues that *group* averages are a rather insecure basis for inference concerning the method a given *individual* may best employ. It is theoretically possible that there are genuine individual differences which make one procedure better for certain persons and another procedure better for others.

The reason I wish to urge for the thesis that we should teach children to add in both directions is based upon the generally recognized desirability of checking numerical operations. Obviously, the result of an addition has worth only to the extent that it is correct. But how shall a person know that a sum is correct? Alas, in school practice it too often means appeal to the teacher or to the answer book! Not so, however, outside of school; there the individual must apply his own checks. Probably the most practicable of these checks—certainly the one in common use by those who do not have access

[1] Buckingham, B. R. "Upward versus Downward Addition," *Journal of Educational Research*, 16: 322, December, 1927.

[2] "Adding Up or Down: a Discussion," *Journal of Educational Research*, 12: 251-61, November, 1925.

to mechanical methods—is simply that of adding the numbers again. Now, a priori, if accidental errors have crept into the process when one has been adding in any particular direction, these same errors will be much less likely if the numbers are taken in a different order, as usually they will be when the direction of addition is reversed. Adding a column in the reverse direction is a better check than adding it a second time in the same direction. This, of course, is but a special application of a principle generally recognized, that of increasing reliability by arriving at a given result by different valid procedures.

If this interpretation is correct, the question as to whether upward or downward addition is the more rapid and more accurate is relatively unimportant. The much more significant task is that of finding the specific difficulties encountered in each, an analytic study that will furnish the basis for an improved technique in teaching both. The above criticism, of course, should not obscure the fact that Professor Buckingham has performed a real service in calling attention to the fact that upward addition and downward addition are really different processes and must be treated as such.

University of Texas H. T. Manuel

NOTE ON THE FINDING OF THE ARITHMETIC MEAN AND THE MEDIAN FROM GROUPED DATA

In connection with the computation of the arithmetic mean and the median from the frequency distribution involving grouped data, a difference of practice exists which is confusing in the teaching of statistics and is causing difficulties in the interpretation of these measures. This difference in practice occurs only when several scores have been grouped into classes. It is the purpose of this paper (1) to describe accurately the differences in practice, (2) to give arguments that have been advanced in favor of and against the practices, and (3) to take a definite position in favor of one of the practices. It is hoped that this expression of opinion will lead to further discussion and that an agreement as to which practice is to be preferred will eventually result.

The matter can best be described through an actual problem. Suppose there be given the scores on a standardized test for a class of sixteen pupils:

25	22	26	15
17	23	14	19
7	37	12	20
18	20	8	22

A frequency distribution of these scores is made with a class interval of five as follows:

Scores	f
35–39	1
30–34	0
25–29	2
20–24	5
15–19	4
10–14	2
5– 9	2
	$N = 16$

In computing the arithmetic mean by the so-called "short method," it is customary to assume a mean as close as possible to the true mean from which to take step deviations. Let us assume the mean in the interval 20-24. The question, "Is the assumed mean 22 or 22.5?" arises; and the two answers to this question determine the two different practices which this paper discusses. If the interval 20-24 extends from the limits of 20.0 to 24.999...., then the assumed mean is 22.5. If the interval 20-24 extends from 19.5 to 24.5, then the assumed mean is 22. If the interval 20-24 is taken as meaning 20-24.999...., then the score 20 must be interpreted as meaning 20-21. But if the interval 20-24 is taken as extending between the limits 19.5-24.5, then the score 20 must be interpreted as meaning 19.5-20.5. If the assumed mean is taken as 22.5, the true mean in the example is found to be 21.9. If the assumed mean is taken as 22, the true mean is found to be 21.4. There is always a difference of .5 of a point score between the means as found by the two methods.[1]

The arguments in favor of taking 22.5 as the assumed mean are:

First, it is worthwhile to draw the distinction between *performance* scales and *product* scales (Garrett). By a performance scale is meant a test where the pupil tries a number of problems or questions, and his score is the number of such items correctly answered. In the illustration given a score of 20 means 20 questions correctly answered, so that the score is at least 20. Presumably, other questions were attempted, some of which may have been partly right, so that the score is greater than 20 but less than 21. In other words, a score of 20 is interpreted as meaning 20-21 for performance scales. In the case of product scales such as a composition scale the score given is as near the true score as it is possible to judge. An assigned score of 20 on a product scale means that the true score lies between 19.5 and 20.5. Hence, 20, interpreted as 20-20.999.... is the convention that should be followed with all achievement and intelligence tests where the score is "number of correct items." This interpretation leads to the convention that an interval of 20-24 means 20-24.999.... and the center of the interval is 22.5.

Second, to interpret an interval of 20-24 as though it extended from 20 to 24.999.... is much more easily understood by the average student than to interpret it as extending from 19.5 to 24.5. Much more elaborate explanations are necessary in order to make clear the reasoning which leads to the latter result. In the interests of teaching when the purpose is to get students able to compute with the least difficulty, the interpretation 20-24.999... is advisable.

[1] A convention in writing the class interval helps in determining the lower limits of that interval. If a test is scored in units, then an interval of five contains the scores 20, 21, 22, 23, and 24, and this would be indicated by 20-24. Since one is the unit of measure, the lower limit of the interval may be taken as .5 below 20, or 19.5. If the unit of measurement is .5, then in the interval beginning with the score 20 there occurs 20, 20.5, 21, 21.5, 22, 22.5, 23, 23.5, 24, 24.5, and the interval would be written 20-24.5. That is, the interval is written to include the first and last scores which could be obtained in that interval. Since the unit of measurement is one-half (.5), the interval extends between the limits 19.75 and 24.75. If the unit of measurement were .1, the interval would extend between the limits 19.95-24.95. To obtain the midpoint of the interval all that is necessary is to average the first and last score of the interval. For instance, to find the midpoint 20-24, add 20 and 24 and divide by 2, namely, $44 \div 2 = 22$. The midpoint of the interval 20-24.95 is $44.95 \div 2 = 22.475$. If the above convention is used in writing the class interval, there should be no confusion.

The arguments in favor of the interpretation 19.5 to 24.5 are:

First, the interpretation of 20-24 as meaning 19.5 to 24.5 brings the use of statistics into accord with measurements in other sciences. In physical measurements a number is taken at its face value; 20 means 20.0 and 20 extends from 19.5 to 20.5.

Second, interpreting 20 as meaning 20-21 on a performance scale is only a convention. It is just as logical to interpret 20 as meaning 19.5-20.5, namely, 20.0 for performance scales as meaning 20-21, that is, 20.5. Both are conventions, but the former makes the use of statistics in education consistent with its use in other sciences.

Third, if one were to find the average of the sixteen scores originally given, he would naturally add them and divide by 16. In such a case, he would treat the score 20 as meaning 20.0. To be consistent the person who interprets 20-24 as meaning 20-24.999.... ought to add .5 to each of the original scores and add 25.5, 17.5, 7.5 etc., in finding the mean. To my knowledge this is never done and it seems absurd that it should be done.

Fourth, to carry on the last argument, if a norm is computed on the assumption that an interval of 20-24 means 20 to 24.999.... then one would be comparing a score for a pupil with a norm which has been computed on a basis .5 higher. This difference matters little with an intelligence test where the score is usually over one hundred points, but if the score is under ten, (as in the Hotz algebra tests) the difference is real and significant.

Fifth, using the argument of authority the interpretation that 20-24 means 19.5-24.5, is recommended by Pearson, Yule, Kelley, Otis, Toops, and Day. On the other side the interpretation 20-24 means 20-24.999.... is recommended by Hines, Monroe, McCall, Rugg, Mills, Thorndike, Thurstone, Garrett, Trabue, Gregory, and Scerist. Although the 20-24.999 interpretation has a large following and is the more popular, the statisticians standing for 19.5-24.5 are authorities of the highest caliber.

In my opinion the arguments for the interpretation 19.5-24.5 are the more convincing and I wish in this paper to put myself on record as favoring that practice. It seems far more important that matters of consistency should outweigh considerations of expediency. I should like to see this disputed point taken up by the Educational Research Association and have that body sanction one or the other practice. At present, practice is far from uniform. It is especially important that practice be consistent in the computation of norms, and, until one or the other procedure is generally sanctioned, norms should contain a statement as to which computing procedure was used.

All this applies to the median as well as the mean. In finding the median the correction should be added to 19.5 as the lower limit of the interval 20-24, rather than to 20 as the lower limit.

Teachers College, Columbia University. PERCIVAL M. SYMONDS

REVIEWS

We have been fortunate to receive two reviews of the book *Public School Business Administration* by N. L. Engelhardt and Fred Engelhardt. We present them together here so that the reader may have the benefit of these two points of view.

B. R. B.

ENGELHARDT, N. L., AND ENGELHARDT, FRED. *Public School Business Administration*. New York, Teachers College, Columbia University, 1927. xiv + 1068 pp.

In *Public School Business Administration* by Engelhardt and Engelhardt we have the first general treatise covering this special field of school administration. At first glance one is impressed by the size of the volume. Any doubt, however, as to whether these many pages constitute the specialized treatment suggested by the book's title is quickly dispelled by a glance at the table of contents. Nor is there needed more than a casual acquaintance beyond this to dispose of the question as to who will make use of such a huge book on school business. Its bulk is not the only reminder the book offers that every problem of school aim, plan, and procedure has its counterpart in the field of ways and means. Accordingly, those who cope with these issues will welcome this book which obviously must serve quite as much as a cyclopedia as it does as a text, since but few universities offer so specialized a course in school administration. The book will serve well as a reference to support courses in general school administration; and, to superintendents, business managers, board members, and principals it will bring a much-needed body of organized information.

If at first the reader regrets the extensive use of scissors, he will later rejoice over the rich collection the authors have garnered from the widely scattered sources in which our knowledge of school business has hitherto been stored. Equally welcome to the practical-minded man, too, will be the hundreds of tables and forms by which the technical details of handling business are clarified and given a concrete setting.

The thirty-five chapters open with a discussion of organization, and, after considering the many aspects of office management, accounting for materials, properties, financial accounts, insurance, budgeting, purchasing, storing, cost service, audits, research, and surveys, they close with a chapter on publicity. In a sense, it is a book of recipes in which the directions are as clear on how to proceed as on what to use. It is more than this, however, for the reader is not left in doubt as to the theory or philosophy of administration back of the directions. Emphasis is placed at every point upon the method of diagnosis and the full reasons for the prescription. It is not intended for clerks, how-

ever, but only for those trained in the fundamentals of education and the fundamentals of business.

If the authors have erred in delimiting the field it has been in the right direction. Here and there are sections that might properly belong to a book on general school administration. It is doubtful if this book would have suffered from a few such omissions. On the other hand, these very passages help to enforce the theory that school business is educational and must be directed by an educator.

One might wish that the authors had used the framework of business organization as a basis for grouping the chapters into parts. This is partly a matter of taste, however, and at most is but small criticism of a book in which the profession may feel a just pride, and from which enormous practical benefits are sure to be derived.

Stanford University JESSE B. SEARS

ENGELHARDT, N. L., AND ENGELHARDT, FRED. *Public School Business Administration.* New York, Teachers College, Columbia University, 1927. xiv + 1068 pp.

Numerous books in the field of school administration have been published during recent years. To date, all of these books have dealt wholly or chiefly with the educational side of school administration, that is, with such topics as the curriculum, textbooks, the teaching corps, extra-curricular activities, pupil personnel, health supervision, and the scientific measuring movement. In all of the treatises on school administration the business affairs of the schools have been neglected. It is with joy and thanksgiving, therefore, that we welcome the first textbook on this much neglected phase of school administration.

The book in question comprises thirty-five chapters, and they treat the most urgent business problems of local school officials. The following randomly selected chapter headings will give the reader an acquaintance with the contents of the book: "The Public-School System as a Business Enterprise," "The Minute Book and the Rules and Regulations," "Office Practice," "General Principles of Public School Accounting," "Property Management in Local School Systems," "Administration and Control of School Bond Issues," "Payroll Procedure and Accounting," and "Statistical Aids to the Fiscal Management of Local Schools." In addition to these thirty-five chapters, which comprise 892 pages, there is an Appendix comprising 156 pages which includes several elaborate records, forms, and transcripts which could not be presented handily in the body of the text.

It is hardly correct to speak of the treatise as a textbook; more accurately it may be dubbed an encyclopedia. Next to Monroe's *Cyclopedia of Education*, it is the largest tome in education, so far as I know. In content and organization, as well as in size, it is cyclopedic. Its chief use, therefore, will be to serve as a reference book; it bids fair to become one of the bibles of the school official. The chief contributions of the book are two: it excellently

summarizes most of the many studies in school business administration; and it includes an innumerable list of up-to-date records, forms, and transcripts which are necessary for an efficient business administration of the schools, particularly in the large city.

If the reviewer be permitted to mention an unfavorable reaction to the book, he would call attention to the frequent lack of a critical evaluation of various practices and the occasional absence of a philosophy. Without these things the "man up the creek" or the neophyte may get beyond his depth in attempting to wade through the 1,068 pages. But the inclusion of such critique and philosophy would have made the book even larger than it is, and it is possible the authors were not entirely oblivious of the interests of the poor reviewer when they omitted this material.

Although I have enjoyed and profited by reading this book—I would commend it to school officials everywhere—I have determined to ask Buckingham, the next time he requests me to review a book, how many pages the book has. How can a reviewer get anything else done? But, if the Engelhardts write another book, and I am requested to review it, I shall gladly consent without asking any questions.

WARD G. REEDER

Ohio State University

SYMONDS, PERCIVAL M. *Measurement in Secondary Education.* New York, Macmillan Company, 1927. xvii + 588 pp.

According to the author's statement, this book aims to be an introductory treatment of measurement, addressed first of all to high-school teachers and principals and, secondarily, to students of measurement. The first three chapters in the book deal with the reasons for measurement in high schools, the need for better measurement, and the methods of improving examinations. Then follow chapters on the testing of intelligence, standardized tests in English, mathematics, science, foreign language, social science, physical education, music, drawing, and commercial subjects.

In his description of tests in the various high-school fields, the author has wisely excluded many tests that were once extensively used. He believes that many of the older tests, as well as many more recent ones, will soon be supplanted by better ones. The busy teacher and administrator need to know the best tests available at present, and how to judge new ones as they appear. The chapter on criteria for the choice of tests discusses in excellent manner the factors that should be considered in choosing tests of any kind.

In addition to his description of a limited number of intelligence tests and standardized tests in the various high school fields, the author devotes a chapter each to the measurement of conduct, prognosis tests, and tests of clerical and mechanical ability. Still other chapters deal with the handling of test results, norms and standards, derived scores, prediction of success in high school, prediction of success in college, use of tests in guidance, promotion, ability grouping, marks and marking systems, and the use of informal tests in teaching.

In the Appendix are found a treatment of various statistical computations, including the technical procedures in determining test reliability, and a list of publishers who print tests.

In writing this book Professor Symonds has performed a timely service. The book is comprehensive in scope and well written. It should immediately find an important place in every high school and in institutions training high-school teachers. Certainly no progressive principal or teacher can today be unacquainted with the best tests for high-school subjects and their proper uses.

Ohio State University D. H. EIKENBERRY

MORTON, ROBERT LEE. *Teaching Arithmetic in the Primary Grades.* viii + 242 pp. *Teaching Arithmetic in the Intermediate Grades.* vi + 354 pp. New York, Silver, Burdett and Company, 1927.

Marked improvement in the books on the teaching of arithmetic should be expected because of the increased number of objective studies of this subject. The two volumes by Morton are concrete examples of the use of scientifically determined facts in writing books on methods of teaching. While the books give evidence of the author's familiarity with the existing literature in this field, they also give evidence of the lack of available knowledge and the need of further research on many topics.

Dr. Morton has wisely presented his material in two volumes, one covering the work of the first three grades, the other the work of Grades IV to VI. The books reflect the treatment not only of the mathematician but also of the psychologist and student of methods of teaching. In both volumes extensive bibliographies are supplied at the ends of the chapters. Also, lists of exercises for class use are provided. It is not clear why an index should be supplied for the first volume and not for the second.

The treatment of the various operations in arithmetic, such as the four fundamental processes, is concrete and full of illuminating detail. The author has used scientific evidence where available; where it is not available he used the best practice determined by his own judgment or that of others. Obviously, in the latter cases there may be differences of opinion, but the author's treatment cannot be described as dogmatic. The chapters on problem-solving are not satisfactory, but they simply reflect the existing lack of knowledge on that subject. The criteria of a good problem, as given on page 191 of the first volume, are well stated. The second volume contains a useful chapter on examinations and their uses.

The author proposes a course of study for the first three grades, but he makes no attempt to do so for the three intermediate grades. In the reviewer's judgment, it is doubtful whether attempts to formulate a general course are advisable at this time. Such attempts must of necessity be based on "authority" rather than "evidence." Progress would probably be more rapid in the long run if the energy now being devoted to writing new courses could be devoted to investigation of fundamental problems which must be

solved before a defensible course can be prepared. The "expert" has little to contribute at this time to the formulation of new courses in arithmetic except the weight of "authority" and this is a doubtful contribution.

Of the available books on the teaching of arithmetic, the reviewer knows of none superior to Professor Morton's two volumes. They have been carefully prepared and have been tested in mimeographed form before being published. They can be recommended to normal school and college instructors of classes in special methods of teaching arithmetic.

University of Chicago G. T. BUSWELL

MORPHET, EDGAR L. *The Measurement and Interpretation of School Building Utilization.* New York, Teachers College, Columbia University, 1927. vii + 102 pp. (Teachers College, Columbia University, Contributions to Education, No. 264)

In this study the author endeavors to answer adequately and objectively the following questions: When is a school building actually being used to practicable capacity? What criteria can be set up to aid in determining when capacity has been reached? What are the factors most likely to affect the percentage of utilization? What data need to be collected in order to study these problems for a particular school? What criteria should be followed and what techniques should be used? On what basis and under what conditions can comparisons with conditions in other schools be presented to the board of education or to the public to be most convincing?

The investigation is confined to the utilization of school buildings during regular school hours and is not concerned with the type or adequacy of equipment and housing facilities. Sixty-four schools located in six different states are included in the study. In the interpretation of the data gathered from these schools certain techniques, including three formulas, were developed. In one chapter of the study dealing with its application, a checking schedule for detailed utilization analysis of school buildings is presented. Because capacity or school-building utilization, particularly with reference to junior and senior high-school buildings, is such an elastic term, the methods and techniques developed in this study should be of considerable value to school administrators in attempting to determine objectively the status of a given school building so far as its utilization is concerned.

Ohio State University T. C. HOLY

DOUGLAS, AUBREY A. *Secondary Education.* Boston, Houghton Mifflin Company, 1927. xxxiii + 649 pp.

It is a rare occurrence for a reviewer to find a book so interesting and providing so much food for thought that he is led to spend several days upon what should be a one-day assignment, yet Aubrey A. Douglass has provided just such a book. It begins with a chapter on secondary—formerly college-preparatory—education as it first appeared in America in the seventeenth

century and concludes with a chapter on extra-curricular activities from the point of view of 1927.

At first glance one is apt to regard this book as an encyclopedia for reference, too detailed in its treatment for consecutive reading. However, one has but to read a few pages to be caught in the current of the book's progressive development and so be carried from page to page and chapter to chapter without skimming or skipping.

The System of Public Education (Part I), possibly better named "the development of secondary education in America," gives a picture of administrative growth with sufficient detail to make it interesting, extending from colonial beginnings to present-day problems in reorganization. In Part II, the Secondary School Pupil, are considered the characteristics of adolescence, individual differences among pupils, pupil elimination, and pupil guidance. The treatment is sound and the text interesting. Pupil guidance is treated at some length, and though the reader who seeks rules of procedure will be disappointed, suggestions are given which will prove valuable to those who are pioneering in this new field. Under the Curriculum, (Part III), are treated aims, materials, processes, and programs with the same broad perspective characteristic of the earlier parts. Different points of view are presented and to an extent evaluated.

Rarely under one cover have so many separate studies been brought into relation, and in so sane a manner. The author has no ideas to sell save the one idea of vision to "increase the judgment of those who would improve the present order through change." To the young student of education the book has the apparent fault of leaving the reader continually in doubt as to what specific treatment a certain situation appears to demand. To the mature reader the book has the outstanding merit of presenting data, raising questions, proposing problems and leaving the reader either to draw his own conclusions from copious data submitted or to close the book better informed but with judgment still suspended as to the most acceptable solution for the problems proposed.

Board of Examiners, New York City JOSEPH K. VAN DENBURG

BAKER, HARRY J. *Characteristic Differences in Bright and Dull Pupils.* Bloomington, Illinois, Public School Publishing Company, 1927. viii + 118 pp.

It has long been known that children differ in intellectual ability, and "bright" and "dull" have been used as adjectives descriptive of this difference. The recognition, however, has not led to extensive modifications in school administration nor classroom procedure. In fact, until quite recently the tendency has been to keep materials, methods, and administrative practices constant and to blame the children if they did not succeed well or caused annoyance during the process. Dr. Baker has contributed much to the clarification of the problem in this book. He has set forth in a convincing manner evidence concerning the general differences in intelligence between bright

pupils and dull pupils, the differences between bright and dull pupils as expressed in terms of subject-matter and the psychology of classroom instruction, and the adjustments of the school organizations which will enable teachers more efficiently to carry out the type of instructional program which is needed.

Through his examination of large numbers of atypical children and the gathering of testimonies of several hundred teachers, he is able to point out these significant differences and to recommend classroom procedures which will benefit the children of both groups. He pays his respects to a number of fallacies which are current concerning general intelligence and calls forcibly to the attention of the reader certain defects in the general program of education which tend to exert an unfavorable influence upon dull pupils.

While the author disclaims the knowledge of a specialist in the various subject-matter fields, he has brought together, for many of the subjects ordinarily taught in the elementary school, clear statements of the characteristic reactions of both dull and bright pupils to the subject-matter and to ordinary methods employed in teaching. He combats the notion that dull pupils do superior work in mechanical lines and emphasizes the significant phases of the work which make their appeal to the two groups. Regarding the teacher of the two groups of children, this quotation best illustrates the message which he is endeavoring to present:

> The teacher who has a group of bright pupils must proceed along quite different lines from the teacher of dull pupils. In dealing with bright pupils the teacher must specialize upon main issues, and direct the general policies. She must be able to short-cut minor details in the interest of making rapid progress. The teacher of dull pupils must be able to make herself a foreman who is primarily concerned with the administration of details. She must have infinite patience to wait for results. Both types of teaching require resourcefulness, intelligence, and adaptability.

The book should be both stimulating and immediately helpful to teachers and supervisors. The reviewer hopes that it will also be read by administrators in order that they may see their own relationship to this very large group of students who are inadequately provided for in our educational system.

Ohio State University E. J. ASHBAUGH

PUBLICATIONS RECEIVED, DECEMBER 15 TO JANUARY 15

BOOKS FOR EDUCATIONAL EXECUTIVES

American Association for Adult Education. *Digest of the proceedings of the second annual meeting.* New York, The Author, 1927. 170 pp.

Burton, E. D. *Education in a democratic world.* Chicago, Univ. of Chicago Press, 1927. 165 pp. $2.00.

Chambers, M. M. *Every man a brick; the status of military training in American universities.* Bloomington, Ill., Public School Pub. Co., 1927. 100 pp. $1.50.

Edmonson, J. B. *New problems in secondary education, with special reference to organization, administration, and supervision.* Bloomington, Ill., Public School Pub. Co., 1926. Unp. (Educational problem series, no. 10) $.75.

Foster, H. H. *High school administration.* New York, Century, 1928. 665 pp. $2.75.

Freden, Gustaf. *Age-grade and progress indices for the public elementary schools of Iowa.* Iowa City, Ia., State Univ. of Iowa, 1927. 52 pp. (University of Iowa studies. First series, no. 128. Studies in education, no. 2) $.75.

Health trends in secondary education; fifty-three schools analyze their health programs. New York, American Child Health Assn., 1927. 153 pp. $1.00.

Kwalwasser, Jacob. *Tests and measurements in music.* Boston, Birchard, 1927. 146 pp. $2.00.

Linton, Clarence. *A study of some problems arising in the admission of students as candidates for professional degrees in education.* New York, Teachers College, Columbia Univ., 1927. 163 pp. (Contributions to education, no. 285) Cloth, $1.50. Paper, $1.25.

Michigan. Education Association. Department of Elementary School Principals. *Studies in the elementary school principalship.* Lansing, The Author, 1927. 96 pp. (First yearbook)

Pennsylvania school journal; educational review, 1927. Harrisburg, Pa., Pennsylvania State Education Assn., 1927. 116 pp. $1.00.

Strayer, G. D., and others. *The Strayer-Engelhardt-Morphet school building utilization forms.* New York, Teachers College, Columbia Univ., 1927. 32 pp. $.50.

Todd, W. H. *What citizens know about their schools.* New York, Teachers College, Columbia Univ., 1927. 86 pp. (Contributions to education, no. 279) Cloth, $1.50. Paper, $1.25.

Ullrich, O. A. *An experimental study of the effect on learning of sectioning college classes on the basis of ability.* Georgetown, Tex., The Author, 1926. 55 pp. $.50.

Wilkins, E. H. *The changing college.* Chicago, Univ. of Chicago Press, 1927. 132 pp. $1.50.

Wood, T. D., and Hendriksen, E. M. *Fresh air in the school room, how to secure it: the school room temperature chart, an aid.* Bloomington, Ill., Public School Pub. Co., 1927. 7 pp.

BOOKS FOR PSYCHOLOGISTS

Commins, W. D. *The effect of education on original differences.* Washington, Catholic Education Press, 1927. 38 pp. (Catholic University of America. Educational research bulletins. Vol. 2, no. 7)

Harper, M. H. *Social beliefs and attitudes of American educators.* New York, Teachers College, Columbia Univ., 1927. 91 pp. (Contributions to education, no. 294) Cloth, $1.50. Paper, $1.25.

Laws, Gertrude. *Parent-child relationships; a study of the attitudes and practices of parents concerning social adjustment of children.* New York, Teachers College, Columbia Univ., 1927. 57 pp. (Contributions to education, no. 283) Cloth, $1.50. Paper, $1.25.

Whipple, G. M. *Problems in educational psychology; eighty exercises designed to supply students of education and teachers in training with material for written reports and classroom discussion.* 3d ed. rev. Bloomington, Ill., Public School Pub. Co., 1927. Unp. (Educational problem series, no. 1) $.75.

BOOKS FOR TEACHERS AND SUPERVISORS

Chesser, E. M. S. *Child health and character.* New York, Oxford Univ. Press, 1927. 204 pp. $1.25.

Donnelly, F. P. *Literary art and modern education.* New York, P. J. Kenedy & Sons, 1927. 328 pp. $1.75.

Fairbanks, H. W. *Real geography and its place in the schools.* San Francisco, Calif., Harr Wagner, 1927. 198 pp. $2.00.

Findlay, J. J. *The foundations of education; a survey of principles and projects.* New York, Holt, 1927. Vol. 2, The practise of education. 382 pp. $3.00.

Fitzpatrick, E. A., and Hutson, P. W. *The scholarship of teachers in secondary schools.* New York, Macmillan, 1927. 208 pp. $2.00.

Fries, C. C. *The teaching of the English language.* New York, Nelson, 1927. 187 pp. $1.60.

Garrison, N. L. *Status and work of the training supervisor.* New York, Teachers College, Columbia Univ., 1927. 98 pp. (Contributions to education, no. 280) Cloth, $1.50. Paper, $1.25.

Johnson, Burges. *Essaying the essay.* Boston, Little, Brown, 1927. 317 pp. $1.00.

Lowden, S. M. *Understanding great poems.* Harrisburg, Pa., Handy Book Corp., 1927. 340 pp. $2.00.

Macomber, M. E. *Playground mystery boxes.* Boston, Badger, 1927. 107 pp. $1.75.

Mohler, Louis. *Teaching music from an appreciative basis.* Boston, Bichard, 1927. 159 pp. $2.00.

Molloy, M. S., and Snyder, M. A. comp. *My musical rating: one thousand "ask me another" questions in musical history, theory, and appreciation.* New York, National Digest Co., 1927. 140 pp. $1.50.

Ogburn, W. F., and Goldenweiser, Alexander. ed. *The social sciences and their interrelations.* Boston, Houghton Mifflin, 1927. 506 pp. $3.50.

Pack, A. N., and Palmer, E. L. ed. *The nature almanac; a handbook of nature education.* Washington, American Nature Assn., 1927. 312 pp. $1.00.

Payne, Wilfred. *Problems in logic.* Bloomington, Ill., Public School Pub. Co., 1926. Unp. (Educational problem series, no. 11) $.75.

Seed, T. R. *Basket work; a practical handbook.* New York, Oxford Univ. Press, n. d. 47 pp. $1.50.

Stoddard, Anne, and Sarg, Tony. *A book of marionette plays.* New York, Greenberg, 1927. 200 pp. $2.00.

Whipple, H. D. *Making citizens of the mentally limited; a curriculum for the special class.* Bloomington, Ill., Public School Pub. Co., 1927. 374 pp. $2.00.

BOOKS FOR HIGH-SCHOOL STUDENTS

Carhart, H. S., and Chute, H. N. *Practical physics.* Rev. ed. Boston, Allyn & Bacon, 1927. 510 pp. $1.60.

Crabb, C. G., and Cheney, Clayton. *The science of getting a job; or, The what, where, and how of winning the position you want.* Milwaukee, Metropolitan Press, 1927. 119 pp. $1.00.

Crabbe, E. H., and Slinker, C. D. *General business training.* Cincinnati, Ohio, South-Western Pub. Co., 1927. 314 pp. $1.32.

Cuentos alegres; a reader for high schools, with exercises. Ed. by N. L. Weisinger. Philadelphia, Winston, 1927. 166 pp. $.60.

De Sauzé, E. B. *Cours pratique de français pour commençants.* Philadelphia, Winston, 1927. 353 pp. $1.60.

Hamilton, C. G. *Touch and expression in piano playing.* Boston, Oliver Ditson, 1927. 72 pp. $.60.

Hamilton, W. F. *Health hints for music students.* Boston, Oliver Ditson, 1927. 81 pp. $.60.

Kountz, Richard. *American ode, chorus for mixed voices.* New York, M. Witmark & Sons, 1926. 24 pp. $.60.

Krickenberger, W. R., and others. *Bobbs-Merrill algebra.* Indianapolis, Bobbs-Merrill, 1927. Book 1. 394 pp. $1.20.

Lewis, H. R. *Productive poultry husbandry.* 6th ed. rev. Philadelphia, Lippincott, 1926. 584 pp. $3.00.

McNamara, E. J., and Markett, M. I. *Rational dictation.* New York, Gregg, 1927. 462 pp. $1.40.

Marcial Dorado, Carolina. *Chispitas, short Spanish plays.* Boston, Ginn, 1927. 226 pp. $1.12.

Marinoni, Antonio, and Passarelli, L. A. *Simple Italian lessons.* New York, Holt, 1927. 204 pp. $1.60.

Masters, W. N., and Floyd, L. P. *High school chemistry.* Dallas, Tex., Southern Pub. Co., 1927. 519 pp. $1.80.

Minneapolis, Minn. West High School. The Script Club. comp. *High school poems.* New York, Harcourt, Brace, 1927. 63 pp. $.75.

Molière, J. B. Poquelin. *L'avare; comedie en cinq actes et en prose.* Ed. by Frederick Anderson. Boston, Ginn, 1927. 162 pp. $.64.

Patterson, Herbert. *Ethics of achievement; an introduction to character education.* Boston, Badger, 1927. 482 pp. $2.50.

Payne, L. W. *Selections from American literature.* Chicago, Rand McNally, 1927. Part 2, Later American writers. 359 pp. $1.50.

Reading, writing, and speaking French. Ed. by Moritz Levi. New York, Holt, 1927. 344 pp. $1.40.

Rogers, C. K. *Clearcut speech in song.* Boston, Oliver Ditson, 1927. 101 pp. $.60.

Saplings, second series, 1927. Pittsburgh, Pa., Scholastic Pub. Co., 1927. 126 pp. $1.50.

Shearcroft, W. F. F. *Qualitative analysis.* New York, Oxford Univ. Press, 1927. 71 pp. $.35.

Steeves, H. R. *Literary aims and art.* New York, Silver, Burdett, 1927. 235 pp. $1.88.

Tennyson, Alfred. *Idylls of the king.* Ed. by R. F. Allen. Philadelphia, Winston, 1927. 232 pp. $.72.

Thompson, Ruth, and Wilson, H. B. *The modern school readers.* San Francisco, Calif., Harr Wagner, 1927. Book 6. 320 pp. $1.12.

Wessely, I. E. *Junior classic French dictionary: French-English and English-French.* Rev. and enl. by A. J. Provost. Chicago, Follett Pub. Co., 1927. 503 pp. $1.00.

Wessely, I. E. *Junior classic German dictionary: German-English and English-German.* Rev. and enl. by A. J. Provost. Chicago, Follett Pub. Co., 1927. 555 pp. $1.00.

Wessely, I. E., and Girones, Louis. *Junior classic Spanish dictionary: Spanish-English and English-Spanish.* Rev. and enl. by A. J. Provost. Chicago, Follett Pub. Co., 1927. 473 pp. $1.00.

Whipple, G. M. *How to study effectively.* 2d ed., rev. and enl. Bloomington, Ill., Public School Pub. Co., 1927. 96 pp. $.60. Exercises in studying. Unp. $.40.

BOOKS FOR JUNIOR HIGH-SCHOOL STUDENTS

Case, J. F. *Tom of Peace Valley, boy knight of agriculture.* Philadelphia, Lippincott, 1925. 232 pp. $1.50.

Haggerty, M. E. *Reading and literature.* Yonkers-on-Hudson, N. Y., World Bk. Co., 1927. Book 1. 567 pp. $1.36. Book 2. 566 pp. $1.36.

Lamprey, Louise. *Long ago in Gaul.* Boston, Little, Brown, 1927. 320 pp. $.75.

BOOKS FOR ELEMENTARY-SCHOOL STUDENTS

Avery, F. L., and Leitzell, F. L. *Prose and poetry.* Syracuse, N. Y., L. W. Singer Co., 1927. Sixth year. 560 pp. $1.70

Baker, R. R. *The Red Brother and other Indian stories.* Ann Arbor, Mich., George Wahr, 1927. 155 pp. $1.25.

Banta, N. M. *Brownies in the greenwood.* Chicago, Flanagan, 1927. 128 pp. $.68.

Bryce, C. T., and others. *Newson readers.* New York, Newson, 1927. Book 1, Good times. Teachers' manual. 176 pp. $.68.

Fairbanks, H. W. *New progressive series of geographies developed according to the problem method.* San Francisco, Calif., Harr Wagner, 1927. Vol. 1, North America. 363 pp. $1.87. Vol. 2, South America. 274 pp. $1.87.

Faris, L. A. *Standard Bible story readers.* Cincinnati, Ohio, Standard Pub. Co., 1925-26. Primer. 128 pp. First reader. 143 pp. Second reader. 159 pp. $.90 each.

George, M. M. *A little journey to England and Wales.* Rev. ed. Chicago, Flanagan, 1927. 184 pp. $.76.

Glenn, Mabelle, and Lowry, Margaret. *Music notes.* New York, Silver, Burdett, 1925-27. Book 1. 31 pp. $.24. Book 2. 31 pp. $.24. Book 3. 48 pp. $.28.

Glenn, Mabelle, and others. *Music appreciation for every child.* New York, Silver, Burdett, 1926-27. Primary grades. 125 pp. $1.00. Intermediate grades. 77 pp. $.60.

Hale, E. M. *Stories of men and nature.* Philadelphia, Lippincott, 1927. 198 pp. $.72.

Lester, K. M. *Great pictures and their stories; interpreting masterpieces to children.* New York, Mentzer, Bush, 1927. Book 1. 93 pp. Book 2. 96 pp. Book 3. 96 pp. $.72 each. Book 4. 128 pp. Book 5. 127 pp. Book 6. 125 pp. Book 7. 125 pp. Book 8. 127 pp. $.80 each.

Lewis, W. D., and Rowland, A. L. *Individual practice material for the silent readers.* Philadelphia, Winston, 1927. First reader. Unp. $.36. Manual. 30 pp. $.10.

Lummis, J. I., and Schawe, Williedell. *Health readers.* Yonkers-on-Hudson, N. Y., World Bk. Co., 1927. Book 1, The safety hill of health. 90 pp. $.68. Book 2, Building my house of health. 136 pp. $.72.

McConathy, Osbourne, and others. *The music hour.* New York, Silver, Burdett, 1927. First book. 92 pp. $.68.

Sewell, Anna. *Black Beauty; the autobiography of a horse.* Philadelphia, Winston, 1927. 297 pp. $1.25.

Van Deusen, E. K. *Picturesque Porto Rico; stories and poems.* New York, Silver, Burdett, 1927. 291 pp. $1.44.

MISCELLANY

Coleman, L. V. *Manual for small museums.* New York, Putnam, 1927. 395 pp. $5.00.

McKerrow, R. B. *An introduction to bibliography for literary students.* New York, Oxford Univ. Press, 1927. 358 pp. $6.00.

A miscellany of tracts and pamphlets. Ed. by A. C. Ward. New York, Oxford Univ. Press, 1927. 565 pp. $.80.

Monroe, W. S., and Asher, Ollie. *A bibliography of bibliographies.* Urbana, Ill., Univ. of Illinois, 1927. 60 pp. (Bureau of Educational Research. Bulletin no. 36) $.25.

Ohio State Educational Conference. *Proceedings of the seventh annual session.* Columbus, Ohio, Ohio State Univ., 1927. 553 pp.

Scripture, Elizabeth, and Greer, M. R. *Find it yourself; a brief course in the use of books and libraries under the contract system.* New York, H. W. Wilson, 1927. Teacher's ed. 62 pp. $.60.

Virginia Polytechnic Institute in the world war. Blacksburg, Va., Virginia Polytechnic Institute, 1927. 167 pp.

Welch, R. D. *The appreciation of music.* New York, Harper, 1927. 192 pp. $2.00.

TESTS AND SCALES

Cavins, L. V. *Cavins' test in American poetry.* Bloomington, Ill., Public School Pub. Co., n. d. Sample set, $.20.

Cheydleur, F. D. *American council French grammar test.* Yonkers-on-Hudson, N. Y., World Bk. Co., 1927. Forms A and B. Specimen set, $.20.

Inglis, Alexander. *The Harvard tests: Latin morphology.* Boston, Ginn, 1927. Forms A, B, C, D, and E. $.48 each.

Inglis, Alexander. *The Harvard tests: Latin vocabulary.* Boston, Ginn, 1927. Forms A, B, C, D, and E. $.48 per pad.

Pintner, Rudolf. *Rapid survey test; intelligence test for grades IV to VIII.* New York, Teachers College, Columbia Univ., 1927. Forms A and B. $1.50 per 100.

Pressey, S. L., and Pressey, L. C. *Chart for diagnosis of illegibilities in handwriting.* Bloomington, Ill., Public School Pub. Co., n. d. $.15 per copy.

Sangren, P. V., and Woody, Clifford. *Sangren-Woody reading test.* Yonkers-on-Hudson, N. Y., World Bk. Co., 1927. Form A. Specimen set, $.20.

Smith, D. E., and others. *Exercises and tests in junior high school mathematics.* Boston, Ginn, 1927. 128 tests. $.48.

Stone, C. W. *New Stone reasoning tests in arithmetic for grades 4 to 9 inclusive.* New York, Teachers College, Columbia Univ., 1927. Form 1. $1.25 per 100.

Stormzand, M. J. *Study-guide tests in American history.* New York, Macmillan, 1927. Part 1, From 1492 to 1860. 64 pp. Part 2, From 1815 to the present. 64 pp. $.40 each.

Thompson, H. G., and Orleans, J. S. *New York Latin achievement test.* Yonkers-on-Hudson, N. Y., World Bk. Co., 1927. Test 2: Form A.

Williams, A. J. *Primary reading test.* Bloomington, Ill., Public School Pub. Co., 1926. 12 pp. Sample set, $.10.